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BIOPHYSICAL RESOURCES OF THE SLOCAN VALLEY

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REPORT HIGHLIGHTS

1. The intent of this report entitled "Biophysical Resources of the Slocan" is to describe the basic physical, biological, and visual characteristics of the landscape.

2. The Slocan valley located in the southern portion of the Selkirk Mountains, lays in a north-south direction, between Lower Arrow Lake to the west and Kootenay Lake to the east.

   (a) The topography contains many mountains which are generally very high and very rugged (over 2800 metres (9200 feet)). The dominant characteristic is the gravity induced downslope movement of soil material, and steep gradient streams.

   (b) Generally the moisture gradients increase from south to north, and from low to high elevation. The soil development, vegetation, and related resources reflect these gradients.

   (c) The highest value land occurs on flat to gently sloping terrain for most resources. The visual resource usually has the highest value on the steepest terrain.

3. The soil association is the fundamental integrating concept, for it qualitatively defines the combined effect of geology, climate, relief, vegetation and time. Resource values are directly related to the kind of soil association which is present.

4. Climatic Moisture Deficits (not to be confused with soil moisture deficit) increase as the potential evapotranspiration increases and as seasonal precipitation decreases. Hence the lower elevations and the steeper southwest facing slopes are drier and potentially suffer from greater moisture stresses. Conversely, since precipitation increases

with increasing elevation and precipitation gradients steepen with steeper topography, climatic moisture deficits decrease with increasing elevation and are quickly reduced with a change of aspect away from the southwest.

5. Accordingly, for ease of description the valley can be divided into:

   (a) Warm and dry climates - predominantly low to medium elevations, more common in the southern end of the valley.

   (b) Cool and moist climates - predominantly medium elevations in the south end of the valley, and low to medium in the north end.

   (c) Cold and moist climates - predominantly high elevations, throughout the valley.

   This is a useful approach to take when describing the climate (and vegetation patterns) in a very general way.

6. More detailed soil capability ratings are provided for agriculture, and forestry; and the climatic capability for agriculture is discussed. Soil stability interpretations are also made.

7. Critical fish habitat areas are described, and sport-fish distribution is defined. The significance of suspended sediment in the stream channel is explained and importance of habitat protection stated.

8. The visual resource in the Slocan is of very high quality, and visual quality objectives are stated. Recreation features are discussed.

9. A framework is proposed for use of the information in this report.

PREFACE

The purpose of this report is to bring together biophysical resource data for the Slocan Valley Planning Program to assist in the preparation of a Regional Land Use and Economic Plan.

The intent of the report is to define the individual climate, soils-terrain, vegetation, aquatics and visual components of the resource base. This will enable clarification of the general opportunities and limitations for resource and land use.

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RESOURCES OF THE SLOCAN

1.0 INTRODUCTION

This report "Biophysical Resources of the Slocan" is intended to provide basic resource information for the Slocan Valley Planning Program. The report brings together information on climate, soil, water, vegetation and the visual components of the resource base. It will help define for the Planning Program, the opportunities and the limitations of the land base. Of course, economic and social information is also required, but is the subject of another report, Technical Appendix, Slocan Valley Planning Program.

As stated in the Terms of Reference, approved by the Environment and Land Use Committee in March 1981, a major part of the program is to "...provide a forum for review of information, ideas and planning concepts so that a flow of information among the planners, resource managers, the local government politicians, and the public is maintained at critical stages of the planning process".

It is intended that this revised and final draft of this report be available to the participants in the latter phases of the planning program.

On the outset, it can be stated that the landscape in the Slocan Valley has one feature which dominates its character; essentially, a very large component is steep. The large vertical changes in topography, with short horizontal distances, has a profound effect on the way the climate is expressed, the kinds of soil, and the kinds of vegetation and aquatic systems. It also has a profound influence on the visual resources.

The importance of the strong topography will become very clear as each component of the resource base is discussed.

2.0 GENERAL CHARACTERISTICS

2.1 PHYSIOGRAPHY

The Slocan Valley is located in the southern portion of the Selkirk mountains in the southeastern portion of the province between the Monashee and the Purcell ranges. Stuart S. Holland in "Landforms of British Columbia" states:

> "The Selkirk Mountains contain some very high and very rugged mountain country. North of the Illecillewaet River there are a number of 10 000 foot (3040 metres) peaks, and the highest peak in the mountains is Mount Sir Sanford (11 590 feet (3532 metres)) in the Sir Sanford Range at the head of Gold River. Between the Illecillewaet River and the Trout Lake-Lardeau River valley there are many 10 000-foot (3040 metres) peaks and three over 11 000 feet (3352 metres), of which Mount Dawson (11 123 feet (3390 metres)) in the Dawson Range at the head of Incomappleux River is the highest. The highest peak in the Slocan Ranges is Kokanee Peak (9200 feet (2804 metres)); in the Valhalla Range, Gladsheim Peak (9275 feet (2827 metres)); farther south the summits are below 8000 feet (2438 metres)."

Concerning the physiography of the Slocan mountains, Holland also states:

> "South of Trout Lake the area is largely underlain by intrusive rocks which Cairnes remarks in the Slocan Mountains "show the strong relief characteristics of a mountainous topography in a late adolescent stage of erosion....The areas of Nelson granite and Kaslo series are normally more rugged and sharper in outline than those underlain by sediments of the Slocan series." The Slocan Ranges are characterized by long, uniformly steep, heavily timbered slopes rising through about 5000 feet (1524 metres) to angular peaks and sharp narrow interconnecting ridges. Cirque glaciers have sculptured the peaks, and high ridges and valley glaciers have facetted the spurs."

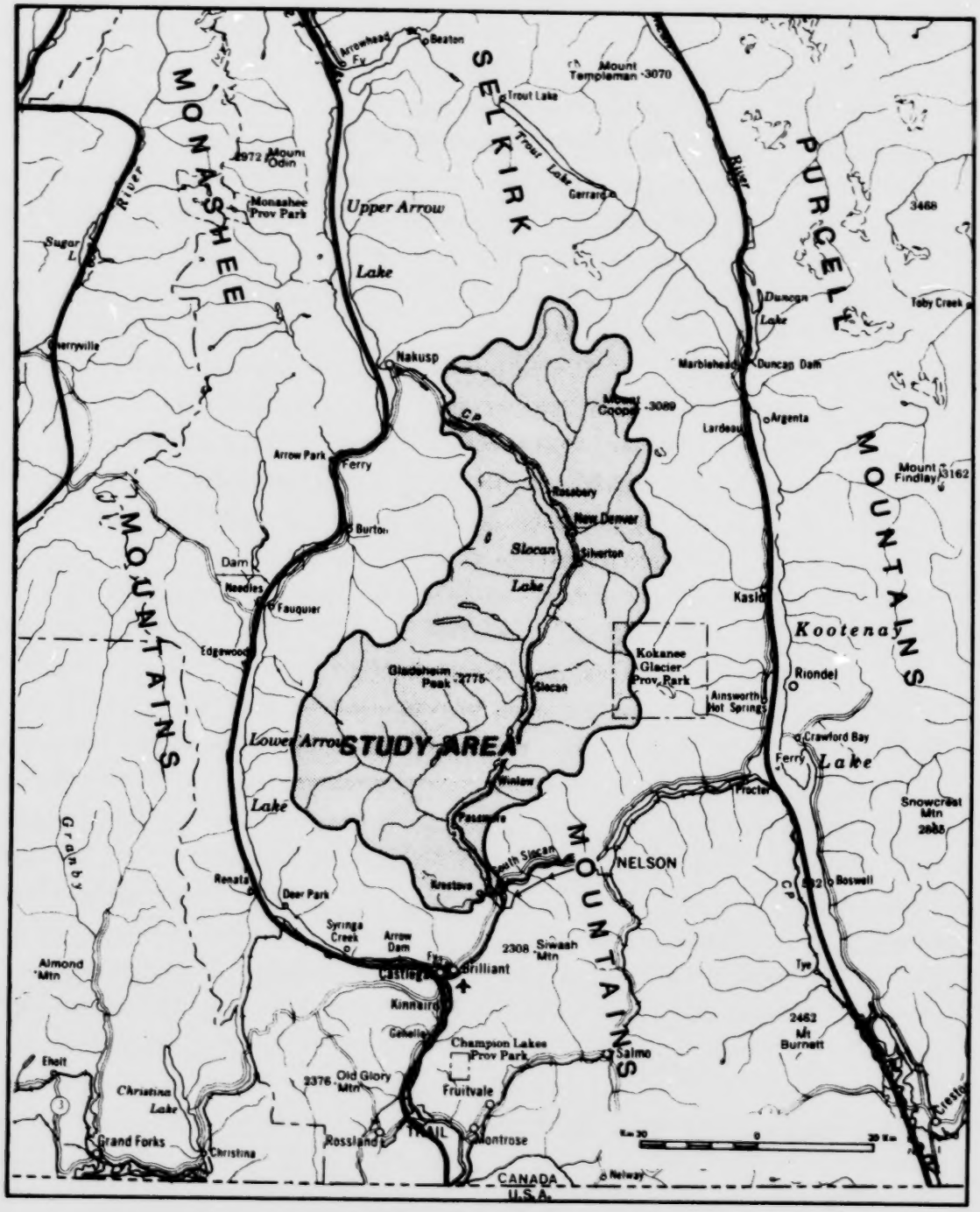


FIGURE 1: PHYSIOGRAPHIC SUBDIVISIONS OF THE SLOCAN VALLEY AND ADJACENT AREA

2.2 CLIMATE

The climate of the Selkirk Mountains and the Slocan River valley has resulted from the complex interaction of the rugged topography of the Cordillera and weather systems which are directed by the prevailing westerly winds. Pacific air masses, having crossed the Coast Mountains, Interior Plateau, and Monashee Mountains, are forced over the Selkirk Mountains where atmospheric moisture is precipitated in amounts unequalled elsewhere in the British Columbia interior.

The climate of the area is continental in nature; having warm summers and cold winters. However, there occurs a wide variety of local climates which reflect the topographic individuality of a wide range of sites. Such climates are affected by latitude, elevation, slope, aspect, distance and direction from major topographic features, and physical surface characteristics.

Solar radiation provides the energy required to drive both the physical and biological processes. Solar energy is used to heat the air, the soil surface, and living organisms. It drives the hydrologic cycle through the provision of energy for evaporation, and transpiration, and powers atmospheric circulation. Since the amount of solar radiation received by any unit of the earth's surface greatly influences local climate, a change in slope, aspect, or surface reflectivity will modify the climatological characteristics of a site. The intersection of river and tributary valleys through the high relief of the Selkirk Mountains creates a complex of slopes and aspects at all elevations. Surface cover of coniferous forests, meadows, rock, and glaciers, present a mosaic of surface reflectivities. Together these factors result in a complex distribution of solar radiation and a myriad of local climates.

As a consequence, temperatures and temperature related parameters such as potential evapotranspiration, growing degree days, climatic moisture deficits and freeze free periods vary widely over short distances. South

and southwest facing slopes receive greater amounts of solar radiation throughout the year. This leads to higher soil and air temperatures, higher rates of potential evapotranspiration, greater potential for climatic and soil moisture deficits, reduced snow depths, and earlier snowmelt. The opposite effects are found on north and northeast facing slopes. In general, temperatures decrease rapidly with increasing elevation.

River valleys and creek draws collect and direct radiationally cooled air. Where surface depressions occur cold air stagnates and results in lower minimum temperatures and shorter freeze-free periods than would occur on better drained areas nearby. Although freeze-free periods as a rule decrease with increasing elevation, the longest periods free from freezing temperatures occur above the valley bottom along the lower slopes of the Slocan River valley.

The rugged topography of the area not only accentuates vertical temperature and precipitation gradients because of its steepness, but further adds to the complexity of local climates through topographic shading. East and west facing slopes along the Slocan valley receive direct solar radiation later in the morning and lose it earlier in the evening. East and west oriented valleys, such as those of Nemo Creek, Enterprise Creek and Gwillim Creek, are frequently shaded at the lower elevations even on the steeply inclined south facing slopes and the heat and water budgets of such areas will reflect this influence.

Annual precipitation in the Slocan Valley ranges from 560 mm (22.0 in.) at some valley bottom locations to over 1900 mm (75.4 in.) at high elevations. Since regional temperatures decrease with increasing elevation, snowfall accounts for a larger proportion of the annual precipitation at higher elevations. The combination of cool temperatures and high precipitation proves beneficial to the hydrology of the area since many of these high elevation areas effectively serve as water storage reservoirs through the heavy accumulation of snow during the winter months and the subsequent melt and release of water throughout the rest of the year.

2.3 BEDROCK GEOLOGY

The bedrock geology (Figure 2) of the Slocan Valley area has been generalized by Jungen (1980) and Wittneben (1980) primarily from Little (1960) and Reesor (1973). Two broad bedrock belts exist in the area: to the south, below Silverton, lies a belt dominated by coarse-grained (acidic) bedrock; to the north, the bedrock is predominantly fine-to-medium grained (basic). The coarse-grained bedrock is mainly of intrusive origin, while the sedimentary rocks of the Slocan group occupy most of the north belt.

2.4 SURFICIAL GEOLOGY

The surficial deposits of the Slocan Valley area have been mapped at a scale of 1:100 000 in conjunction with soil mapping by Jungen (1980) and Wittneben (1980). Both reports also contain a generalized map showing the distribution of major surficial material types, which is represented in Figure 3.

After the glaciers in the Slocan Valley melted away approximately 10 000 years ago, several distinctive deposits were left. Morainal or till materials were deposited directly by the glaciers themselves. They generally occur on moderately sloping terrain above the valley bottoms. The till material is dominantly moderately coarse-textured, reflecting the influence of the coarse-grained bedrock which is dominant in the valley. These materials are mainly well to moderately well drained.

Fluvial and glaciofluvial materials, which have been deposited by rivers often in contact with glaciers, occur along the Slocan Valley and along the bottoms of most of the major tributaries, such as Little Slocan River, Lemon and Wilson Creeks. These deposits are dominantly coarse-textured, consisting of sand and/or gravel material. They are usually well to rapidly drained.

Active fluvial or floodplain deposits also occur in the valley. They are generally confined to the small channels associated with the areas

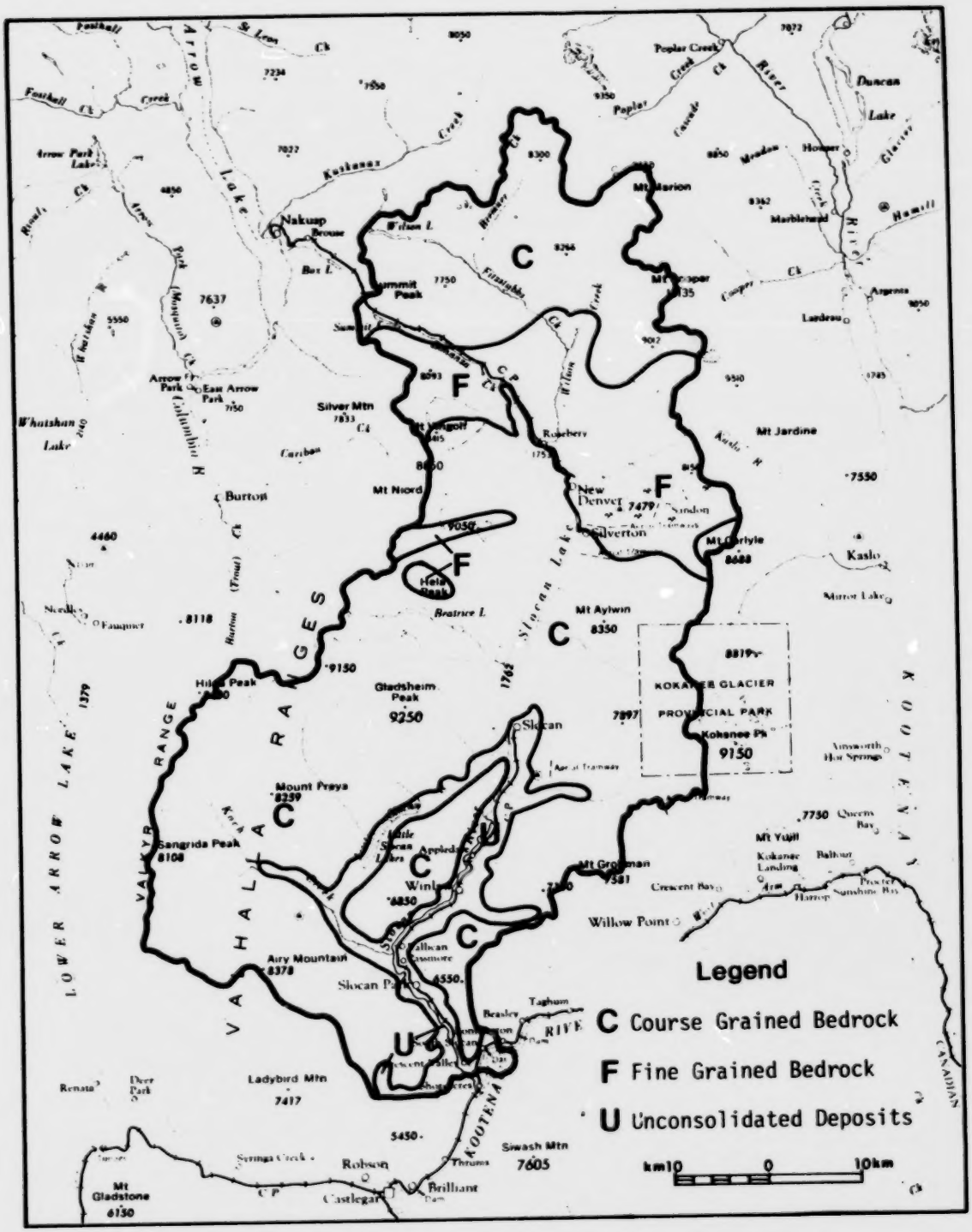


FIGURE 2: GENERALIZED BEDROCK IN THE SLOCAN VALLEY AREA

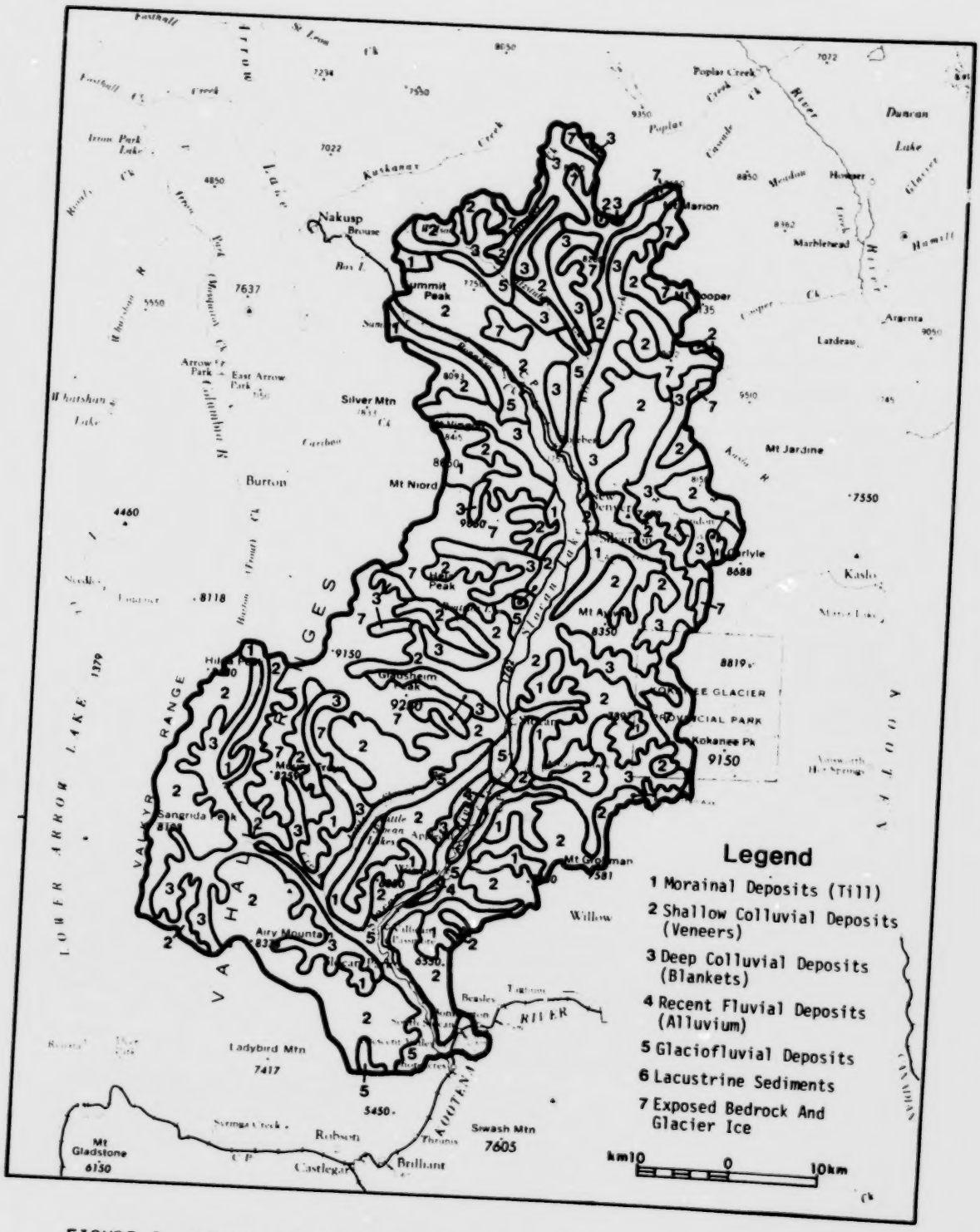


FIGURE 3 GENERALIZED SURFICIAL DEPOSITS IN THE SLOCAN VALLEY AREA

rivers and creeks; they are, however, more extensive along the Slocan River. Due to periodic flooding and seasonally high water tables, these materials are generally imperfectly drained.

The most widespread material in the valley is colluvium. Colluvial materials have been deposited by gravity-induced movement, and occur on the valley's steeper slopes. Since colluvial materials often consist of shattered bedrock, they are generally coarse-textured and well to rapidly drained. Also common in the valley is exposed bedrock, especially in the higher peaks of the Valhallas and Kokanees.

3.0 RESOURCE CHARACTERISTICS

3.1 SOILS

The soils of the Slocan Valley have been mapped at a scale of 1:100 000 by Jungen (1980) and Wittneben (1980). Each soil in the Slocan Valley is described in considerable detail in these two reports. Soils have inherited many properties from their parent (surficial) materials, such as texture and drainage, as already described; thus surficial materials are used in the recognition of distinct soils for the valley. A key to some of the common soils which occur in the valley is shown in Table 1 (see Reference Map 1 in Appendix I).

Youthful soils (Regosols) reflecting periodic flooding occur on floodplain and active fluvial fan deposits. Above these deposits, in the valley's lower elevations, moderate soil weathering due to moderate precipitation has produced Brunisolic soils. In higher elevations, due to increased levels of precipitation, more intense weathering has led to the formation of Podzolic soils. Actively depositing talus - scree deposits are the main area of Regosolic soils at high elevations.

The soil and surficial materials mapped in the Slocan Valley by Jungen (1980) and Wittneben (1980) have been interpreted for a number of land uses, including agriculture, forestry, and engineering. Agriculture and forest capability maps have been produced, with very generalized maps also available in their report. Each soil's engineering properties are described in the reports, with some interpretations provided related to rural settlement. Four of these interpretations have been mapped from the base soil maps and are briefly discussed below.

3.1.1 Soil Capability for Agriculture (modified from Jungen, 1980)

Soil capability for agriculture ratings are an interpretation based on soil survey and climate data. The classification emphasizes the range of

TABLE 1
KEY TO THE COMMON SOILS OF THE SLOCAN VALLEY
(modified from Wittneben, 1980)

FOREST ZONES	SURFICIAL MATERIALS		SOIL ASSOCIATION		DOMINANT SOIL SUBGROUP CLASSIFICATION
			NAME	SYMBOL	
Interior western hemlock - western red cedar zone	Shallow colluvium derived from, and overlying bedrock	coarse grained bedrock	Buhl Creek	BH	Orthic Humo-Ferric Podzol
	Deep colluvial deposits	coarse textured colluvium	Cooper Curtis	CP CT	Orthic Humo-Ferric Podzol Sombric Humo-Ferric Podzol
	Glacial till deposits	coarse textured till	Slocan	SN	Orthic Humo-Ferric Podzol
	Glaciofluvial deposits	sandy glaciofluvial deposits gravelly glaciofluvial deposits	Gillis Glenlily	GS GY	Orthic Dystric Brunisol Orthic Dystric Brunisol
		coarse textured glaciofluvial ice contact (kames) and terrace deposits	Kaslo Kinert	KO KR	Orthic Humo-Ferric Podzol Orthic Dystric Brunisol
	Fluvial deposits	fluvial fan deposits	Fletcher	FR	Orthic Dystric Brunisol
		recent fluvial deposits (floodplain)	Avis	AS	Orthic Regosol
	Lacustrine deposits	medium and fine textured lacustrine deposits	Lawley	LY	Brunisolic Gray Luvisol
Subalpine Engelmann spruce - alpine fir zone	Shallow colluvium derived from and overlying bedrock	coarse grained bedrock	Beatrice	BC	Orthic Humo-Ferric Podzol
	Deep colluvial deposits	variable textured colluvium (talus)	Ymir	YR	Orthic Regosol
	Glacial till deposits	coarse textured till	Swehaw	SH	Orthic Humo-Ferric Podzol

Hazard Notes:

Avis soils are subject to flooding.
Curtis soils are subject to snow avalanches.
Ymir soils are subject to rock fall.

regionally adapted arable crops which can be grown and is applied to non-cleared as well as presently cultivated land. It groups soils into seven classes with Class 1 having no limitations for production of regionally adapted crops and Class 7 having no capability for arable agriculture or natural grazing.

The following is a brief description of the capability classes:

Class 1 - Soils in this class have no significant limitations for the production of regionally adapted crops.

Class 2 - Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.

Class 3 - Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.

Class 4 - Soils in this class have severe limitations that restrict the range of crops or require special conservation practices or both.

Class 5 - Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible.

Class 6 - Soils in this class are capable only of producing perennial native forage crops, and improvement practices are not feasible.

Class 7 - Soils in this class have no capability for arable culture or permanent pasture.

The best soils for agriculture in the Slocan area are located on fluvial and lacustrine deposits. Other lands suitable for arable agriculture include some glaciofluvial terraces, fluvial fans, and glacial till deposits. The medium to coarse-textured low water holding soils usually improve significantly in their agricultural capability when irrigated.

Figure 4 is a very generalized agriculture capability map highlighting the occurrence of high and moderate capability lands in the Slocan valley.

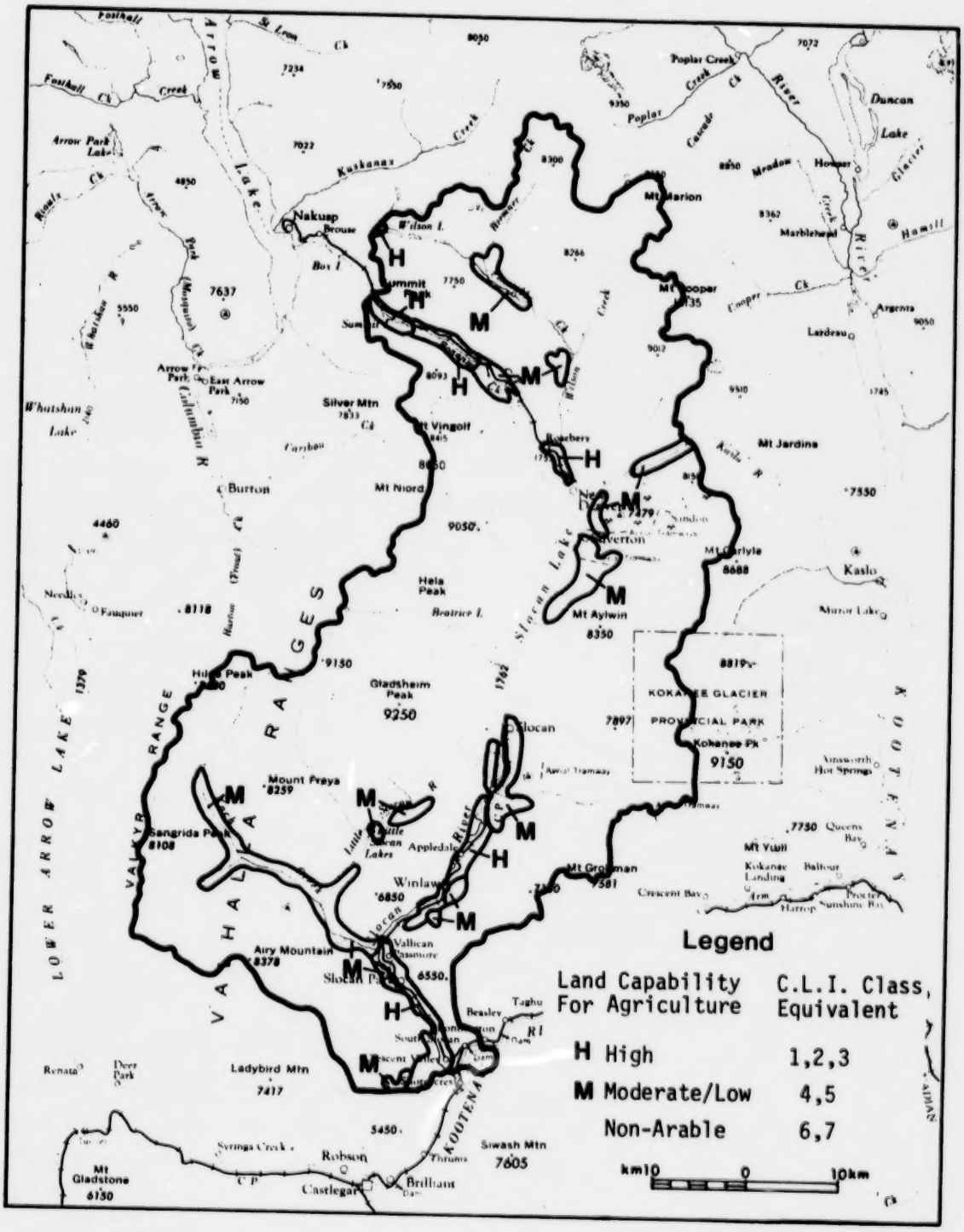


FIGURE 4: GENERALIZED AGRICULTURE CAPABILITY IN THE SLOCAN VALLEY AREA

Please refer to Appendix I for information on the availability of more detailed maps.

3.1.2 Soil Capability for Forestry (modified from Jungen, 1980)

The Canada Land Inventory Soil Capability for Forestry was the basis for determining the forest capability of the soils in the survey area. Individual soil association components were rated according to the inherent ability to grow trees. Factors such as soil profile development, topography, climate, moisture regime, parent material, as well as tree species characteristics were all taken into account. The capability rating, therefore, is an expression of most of the important environmental factors as they apply to tree growth.

The capability of each soil to grow wood fibre was determined by locating and measuring representative (selected fully stocked healthy stands) forest productivity plots on the various soils.

Plots were measured according to standard Canada Land Inventory methods. Plot data was then summarized according to each soil and average capability ratings determined. These ratings, as well as information from air photo interpretation, field observation, British Columbia Forest Service Inventory and forest cover maps, soil, vegetation and climate maps were used to produce the forest capability maps.

A summary of the productivity of each of the Soil Capability for Forestry classes is listed below:

Capability Classes	Mean Annual Increment (MAI) of Wood Growth per Year (m^3/ha/yr)
7	0 - .7
6	0.8 - 2.1
5	2.2 - 3.5
4	3.6 - 4.9
3	5.0 - 6.3
2	6.4 - 7.7
1	7.8 - 9.1

Figure 5 is a very generalized forest capability map highlighting the occurrence of high and moderate capability lands in the Slocan valley area. Please consult Appendix I for information on the availability of more detailed maps.

3.1.3 Soil Factors Affecting Mass Movement

Soil Mass Movement (from Jungen, 1980)

Soil mass movement (or soil stability) involves the downslope movement of soil primarily under the force of gravity. Soil mass movement ranges widely in surface form, speed of movement, and volume of material moved. Mass movement events range from spectacular debris avalanches and flows to a slow downward creep of an entire hillside (see Reference Map 2).

The mode of failure and subsequent downslope movement of these mass erosion mechanisms depends greatly on soil depth, degree of cohesion, and soil water content. As a general rule, debris avalanches and debris flows result from failure of a relatively shallow, cohesionless soil mass on steep slopes as a consequence of surface loading, increased soil water levels, removal of mechanical support, or a combination of all three.

Creep is the slow, continuous downslope movement of mantle material as the result of long-term application of gravitational stress. It occurs in varying degrees in association with most other types of soil mass movement, but dominates as a major process in itself on slopes covered with deep, cohesive soils. The movement is quasiviscous, occurring under shear stresses sufficient to produce permanent deformation but too small to produce discrete shear failure. For areas where soil creep is a major erosion process, it serves as a critical factor in the progressive failure of overconsolidated materials ultimately resulting in the slump and earthflow.

Slumps and earthflows are closely related in terms of their occurrence and genetic process. Both types characteristically develop on deep soils

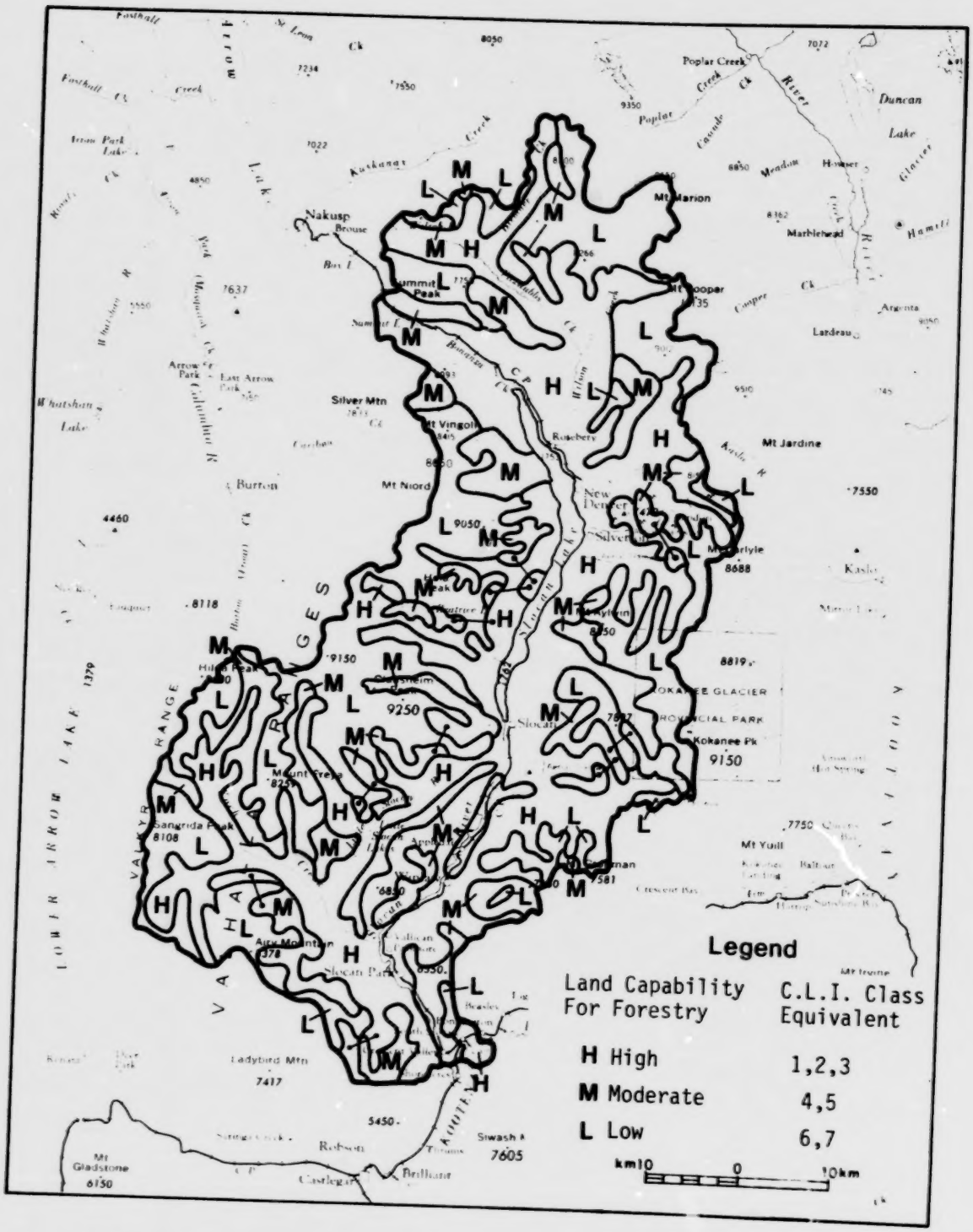


FIGURE 5: GENERALIZED FOREST CAPABILITY IN THE SLOCAN VALLEY

and are frequently associated with deep-seated creep. They begin initially as rotational failures usually triggered by soil saturation and rapid increases in pore water pressure in the immediate area of failure. Slumping involves the downward and backward rotation of a soil block or group of blocks with small, lateral displacement. The main scarp has a steep headwall and is generally bare and concave toward the toe. The toe is hummocky or broken by individual slump blocks and, if an earthflow is involved, may be lobate in shape. Earthflows frequently incorporate much larger masses of soil which move downslope through a combination of flowage and slumping.

Dry ravel requires bare, granular soil and either a lack of surface moisture or presence of moisture and active freeze-thaw cycles.

Root systems, age of trees, cohesive strength of the soil, low slope angles, and unsaturated soil conditions tend to enhance soil shear strength, minimizing slope failures. After harvesting on steep slopes, the decay of root systems and changes in water regime leading to local saturation may enhance the occurrence of slope failures.

Road building is probably the most damaging activity. Road construction in active or dormant creep and slumping areas is highly likely to accelerate or reactivate the soil mass, largely through alteration of the balance of forces acting on the slope. Timber removal probably exerts its greatest impact through alteration of the natural slope hydrology, producing unstable conditions during critical storm periods.

Factors Contributing to Mass Movement (from Jungen, 1980)

a) Slope gradient - Generally the steeper the slope the greater the hazard. The increase in slope gradient due to stream erosion or removal of physical slope support can lead to unstable slopes.
b) Texture - Some soil textures and soil properties associated with texture are more prone to mass movement than others, e.g. silts and fine sands (low bulk density, low bearing strength, weak structure,

low shear strength, moderate percolation rate) are more prone than a gravelly sandy loam.

c) Moisture status - The behaviour of dry material often varies drastically from that of saturated materials. Some material with bandings of silts and fine sands are also in topographic positions that receive and conduct moisture, e.g. kame material at base of till slopes; silts and fine sands in coastal climates. Pressure is exerted on soil particles by ground water which weakens the stability of slopes. Ground water can wash out soluble cementing agents, thereby weakening intergranular bonds. This decreases cohesion and lowers internal friction. Seepage water can also remove fine particles (silts and clays) in the soil and form underground cavities which weaken the stability of the slope.

d) Climate - Precipitation, its occurrence and distribution is a key factor in predicting soil mass movement on a regional basis. Most soil mass movements are triggered by soil saturation and positive pore water pressures produced by rainfall periods of high intensity or long duration.

e) Soil and surficial material characteristics -
   1. Type of surficial material;
   2. Occurrence of compacted, cemented, or impermeable layers;
   3. Diagnostic soil characteristics:
      i) Soil depth;
      ii) Texture;
      iii) Clay mineralogy;
      iv) Angle of internal friction;
      v) Cohesion.

f) Bedrock lithology and structure -
   1. Rock type;
   2. Degree of weathering;
   3. Attitude of beds;
   4. Degree of fracturing.

g) Vegetation -
   1. Type of vegetation and its distribution on steep slopes;

2. Root distribution and degree of root anchoring in the subsoil;
3. Age of vegetation.

h) Natural earthquakes or man caused shocks or vibrations during critical periods will trigger slides.

i) Overloading of slopes from sidecast material from road building or other disturbances can lead to local landslides.

Evidence of Past Mass Movement Include the Following:

a) Hummocky, disarranged topography.
b) Leaning trees and bent trunks (pistol-butt).
c) Disorderly and trunkated sequences of soil horizons or materials in soil profiles.
d) Poorly developed drainage system accompanied by luxuriant growth of water-loving plants.
e) Crescent shaped scars; long narrow surface scars.

Mass Movement Hazard Ratings (modified from Jungen, 1980)

Each soil association described and mapped by Jungen (1980) and Wittneben (1980) was placed into one of four stability groups (I, II, III, IV) depending on various factors affecting mass movement regardless of topography. The system ranges from Group I (most stable) to Group IV (least stable).

I - Stable soils (e.g. very coarse soils)
II - Moderately stable soils (e.g. medium-textured soils with high bearing strength coarse-textured colluvial soils)
III - Unstable soils (e.g. clay soils in dry environment, medium-textured soils in wet environment)
IV - Very unstable soils (e.g. silts or fine sands)

Each stability group was then given a mass movement susceptibility rating by taking into consideration the topographic classes (slopes) on

TABLE 2
SUSCEPTIBILITY OF SOIL ASSOCIATIONS TO MASS MOVEMENT

SOIL STABILITY GROUP	SOIL ASSOCIATION SYMBOLS	TOPOGRAPHY CLASSES*										
		<E	E	EF	FE	F	FG	GF	G	GH	HG	H
I	FR, FT, GE, GY, GR, KO1,2, KR, TL											
II	AS, BC, BK, BN, BO, BG, BH, BE, CL1,2,4,5, CA, CE, CF, GL, GS, KO3,4, SO, SL1,2,5,6, SY, TY, SG				SLIGHT							
III	BZ, BU, CL3, CH, CF2, CP3, SA, SL3, SS1,2, SN3, SH							MODERATE				
IV	CS, CT, KK, LY, LH, LR, RL, SS3, YR, CN									SEVERE		

Soil Stability Groups

I Stable soils
II
III
IV Unstable soils

Symbol	Slope %
A	0 - 0.5
B	0.5 - 2
C	2 - 5
D	5 - 9
E	9 - 15
F	15 - 30
G	30 - 60
H	over 60

which these materials may be found. Stable soil groups were given a "severe" rating on much steeper slopes than the unstable soil groups. Table 2 summarizes how the symbols on the base soil maps were evaluated to arrive at these ratings.

Mass Movement Hazards Map

A map showing "Soil Factors Affecting Mass Movement" was prepared specifically for this study based on the above ratings and the available 1:125 000 soil maps for the area. Important qualifications are noted in the legend on this map .

3.1.4 Soil Limitations for Residential Settlement

A map showing "Soil Limitations for Residential Settlement" was prepared specifically for this study in response to a request from the Central Kootenay Regional District. The map is based on an interpretation of the 1:125 000 soil maps for the Slocan area using the general criteria outlined by Maynard (1979). Important qualifications are noted in the legend on this map (see Reference Map 3).

3.2 VEGETATION

3.2.1 Vegetation Patterns

The material presented in this report was largely extracted from "Vegetation Inventory and Interpretations of the Nelson Area" (J.W. van Barneveld, in preparation). Throughout this report plant names conform with those of Taylor and MacBryde (1977).

The broad regional climate and topography of the Slocan Valley Planning Area is the most important determinant of the general vegetation patterns which are characteristic of the Interior Wet Belt Region (IWB). The vegetation of the Interior Wet Belt Region reflects a complex pattern of storm

tracks, cold air pooling and drainage, aspect as it affects insolation, wind at higher elevation, precipitation, snowfall patterns, and the effect of each of these factors has on snow cover and soil moisture regimes. These complex relationships between environmental factors create a highly variable vegetation pattern. This pattern and some of its major variations are depicted in Table 3.

The Interior Wet Belt Region is characterized by the Interior western hemlock-western red cedar (IwH-wC) forest Zone. Within this zone typical well drained, medium-textured sites of near-normal soil chemistry are capable of producing a self-perpetuating forest of western hemlock and western red cedar. This Forest Zone reflects precipitation in excess of 450 mm (17.55 in.) (Marsh, pers. comm.) and a snowcover sufficient to insulate the ground from frost. The upper and lower limits of this zone and of the zones associated with it reflect more precisely the variations in the regional climate. Such sub-regional climates are further reflected in the successional vegetation.

Following natural or man-made disturbances, successional vegetation precedes the self reproducing vegetation (climax). Differences in the dominant species that can occur in the successional vegetation are the basis on which most subzones are defined. On the basis of variations in associated zones and subzones within the study area Sections of the Interior Wet Belt may be recognized. These are: Creston Section, Nelson Section, and Trout Lake Section.

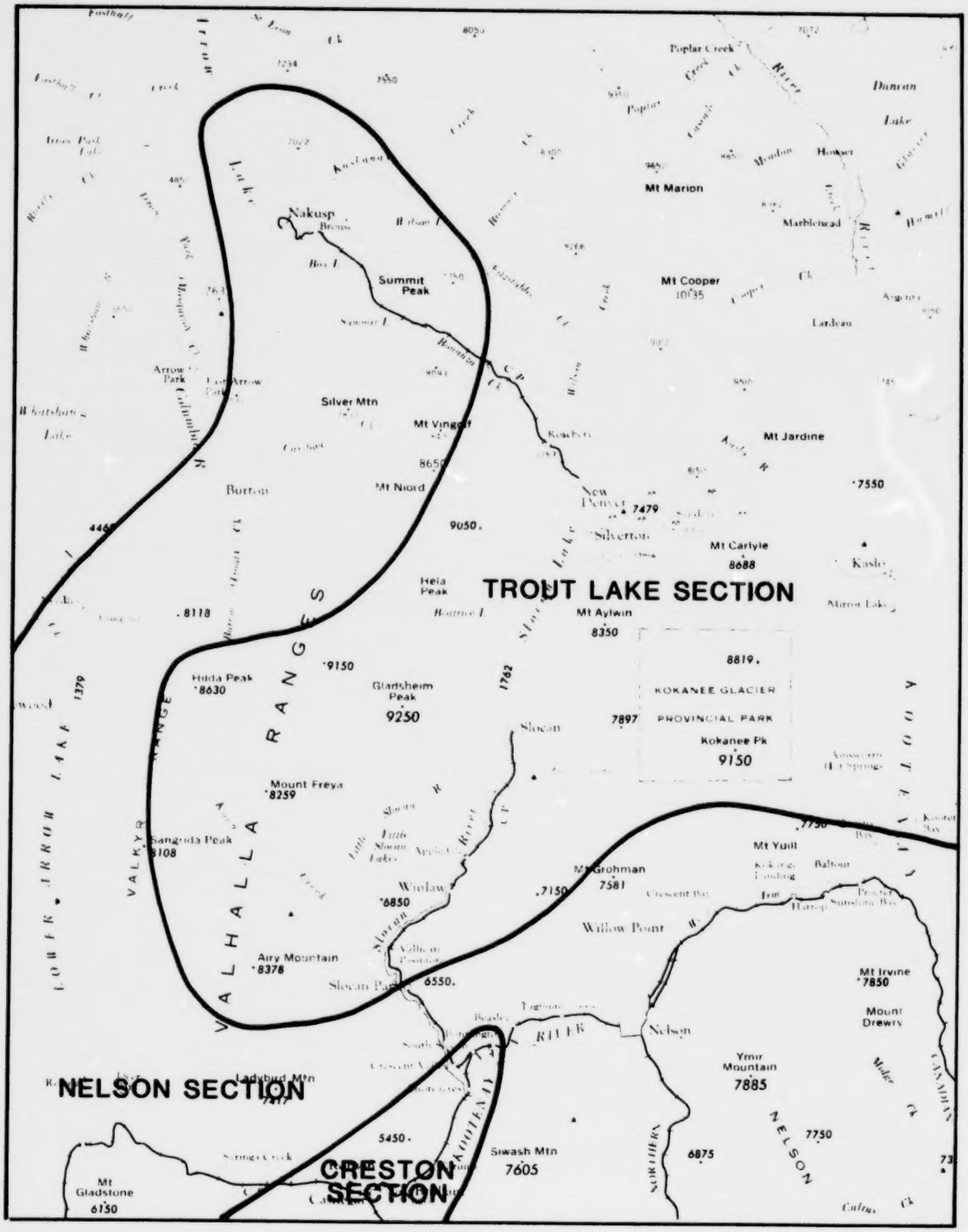


FIGURE 6: VEGETATION SECTIONS IN THE SLOCAN VALLEY

TABLE 3

BIOPHYSICAL FOREST ZONE[1] AND SUBZONE[1] DIVISIONS OF THE INTERIOR WET BELT (IWB) REGION[1] OF BRITISH COLUMBIA

FOREST ZONE		SUBZONE		GENERAL LOCATION
NAME	ALTITUDINAL LIMITS UPPER - LOWER	NAME	ALTITUDINAL LIMITS UPPER - LOWER	
Alpine tundra (At)	- 7900' (8300') [2400 m (2530 m)]	No subzonation available		At the peaks of higher mountains.
Subalpine Engelmann spruce - alpine fir (SAeS-alF)	7900' (8300') - 4900' (3900') [2400 m (2530 m) - 1490 m (1190 m)]	krummholz	7900' (8300') - 7400' (6700') [2400 m (2530 m) - 2250 m (2040 m)]	At high altitudes of higher mountains throughout the study area.
		lodgepole pine (No Rocky Mountain Douglas-fir; whitebark pine may be associated with the upper parts of this subzone upwards to timber line)	7400' (6700') - 4900' (4100') [2250 m (2040 m) - 1490 m (1250 m)]	Throughout the study area at moderately high altitudes.
		Rocky Mountain Douglas-fir - lodgepole pine	5100' (6000') - 4000' (3900') [1550 m (1830 m) - 1490 m (1190 m)]	Near major valleys at intermediate to moderately high altitudes.
Interior western hemlock (IwH)	5100' (6000') - 4500' (4100') [1550 m (1830 m) - 1370 m (1250 m)]	lodgepole pine - Engelmann spruce - alpine fir	5100' (6000') - 4900' (4500') [1550 m (1830 m) - 1490 m (1370 m)]	In the mountains away from the major valleys at moderately high altitudes.
		lodgepole pine - (Engelmann spruce)	4900' - 4500' (4100') [1490 m - 1370 m (1250 m)]	In the mountains away from the major valleys at intermediate altitudes.
Interior western hemlock - western red cedar (IwH-wC)	(6000') 5100' - 2000' (1500') (4100') [(1830 m) 1550 m - 610 m (460 m)] (1250 m)	lodgepole pine - Engelmann spruce - alpine fir	4900' (6000') - 4200' [1490 m (1830 m) - 1280 m]	In the mountains away from the major valleys throughout the study area.
		Rocky Mountain Douglas-fir - lodgepole pine - western larch	5100' (6000') - 2000' (3900') [1550 m (1830 m) - 610 m (1190 m)]	Throughout the study area at intermediate altitudes.

TABLE 3 (Continued)

FOREST ZONE		SUBZONE		GENERAL LOCATION
NAME	ALTITUDINAL LIMITS UPPER - LOWER	NAME	ALTITUDINAL LIMITS UPPER - LOWER	
Interior western hemlock - western red cedar (IwH-wC) (Continued)		Rocky Mountain Douglas-fir - ponderosa pine	2900' (3900') - 2000' (1500') [880 m (1190 m) - 610 m (460 m)]	Lower Kootenay Lake valley, Columbia River valley south of Burton, lower Slocan and Arrow Lakes.
Interior western red cedar (IwC)	2900' (3900') - 1500' [880 m (1190 m) - 460 m]	Rocky Mountain Douglas-fir	3900' - 2900' (2000') [1190 m - 880 m (610 m)]	Not in study area.
		Rocky Mountain Douglas-fir - ponderosa pine	2900' (3900') - 1500' [880 m (1430 m) - 460 m]	West and southwest of Slocan valley.
Interior grand fir - western red cedar (IgF-wC)	2900' (4700') - 1500' [880 m (1430 m) - 460 m]	Rocky Mountain Douglas-fir - ponderosa pine	2900' (4700') - 1500' [880 m (1430 m) - 460 m]	Lower Kootenay Lake valley, Pend'Oreille River valley.

[1] For a definition of these climax and succession oriented terms see: Natural Resource Inventory: Methodology, Interpretations and Availability, Centre of Continuing Education, UBC, 1976.

[2] The numbers in parentheses indicate extremes. Metric equivalents are presented in squared brackets.

Creston Section

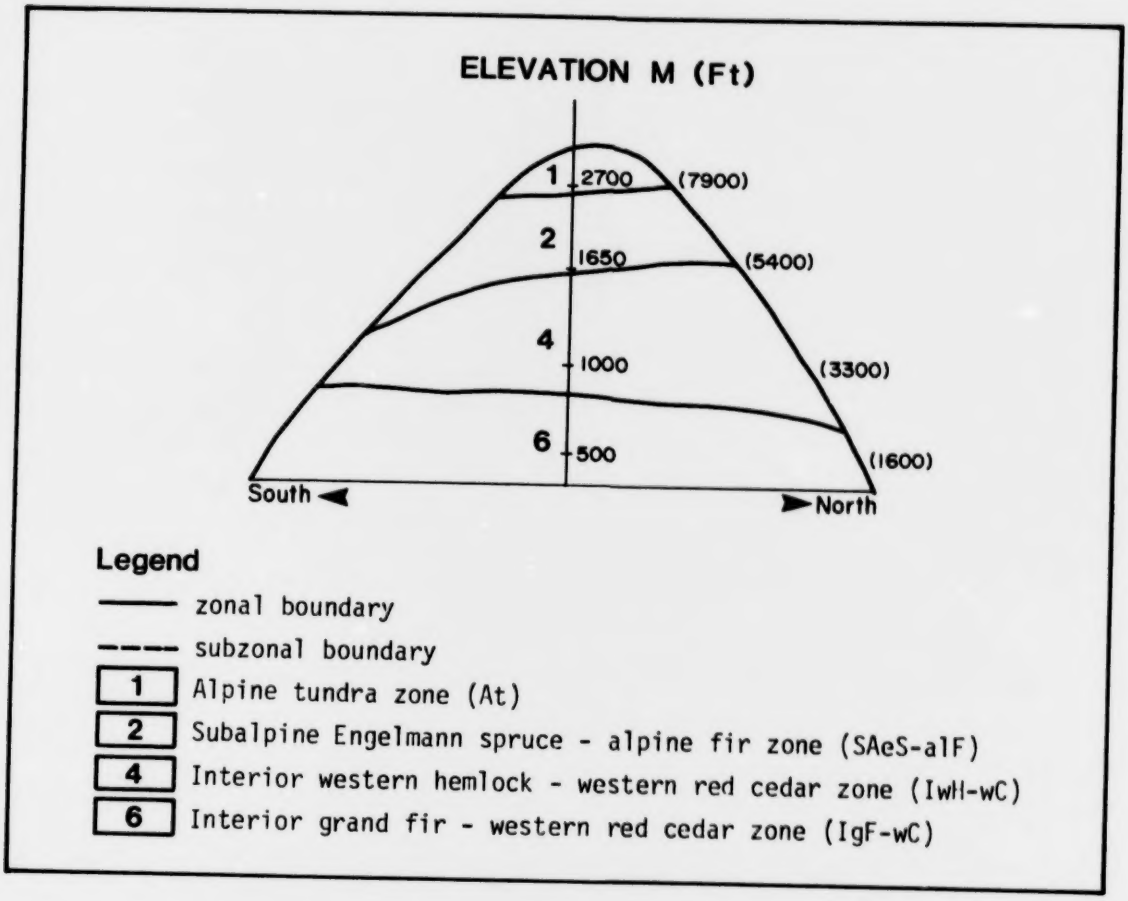


FIGURE 7: TYPICAL PATTERNS OF ZONES AND SUBZONES OF THE CRESTON SECTION

The Creston Section of the Interior Wet Belt is found in association with the major valleys south of Kootenay Lake, the Pend'Oreille River, and the Columbia River approximately southwards from South Slocan. The Interior grand fir-western red cedar zone is characteristic for this drier section.

In the study area the Interior grand fir-western red cedar zone reflects high temperatures in summer, a relatively long growing season and limited precipitation. The combination of high temperatures and limited precipitation may create considerable moisture deficiencies. On the driest sites the ultimate, self-perpetuating vegetation may be characterized by Douglas-fir with an understory of ocean spray, mock-orange, Oregon-grape, pine grass, western fescue, common western pipsissewa and a thin moss layer, or even a dry forest type characterized by ponderosa pine and bluebunch wheat grass. For the management and use of such vegetation, it must be understood that the controlling mechanisms differ from that in the drier areas of the interior of the province in that they are subject to greater precipitation. The winter precipitation in particular may have a substantial leaching effect on the nutrient regimes of the upper parts of the soil.

In these relatively warm areas the Interior western red cedar-western hemlock zone may tend to be limited in altitudinal extent, since the high temperatures will also adversely affect snow cover and moisture availability at higher elevations. Also reflecting the presence of relatively warm air may be the occurrence of a Rocky Mountain Douglas-fir subzone in the lower parts of the Subalpine Engelmann spruce-alpine fir zone.

In the upper parts of the Subalpine Engelmann spruce-alpine fir zone (including the krummholz subzone) is a noted tendency for the formation of nearly permanent grassy vegetation types. The effects of a combination of exposure to sun and wind, and repeated fires (natural and from the early 1900's mining activities) possibly locally amplified with wildlife use has created a substantial "sod" of grassroots. Re-invasion by trees of these already marginal sites is further prevented by the established grasses. Such a permanent plant community resulting from disturbances is referred to as "disclimax".

Nelson Section

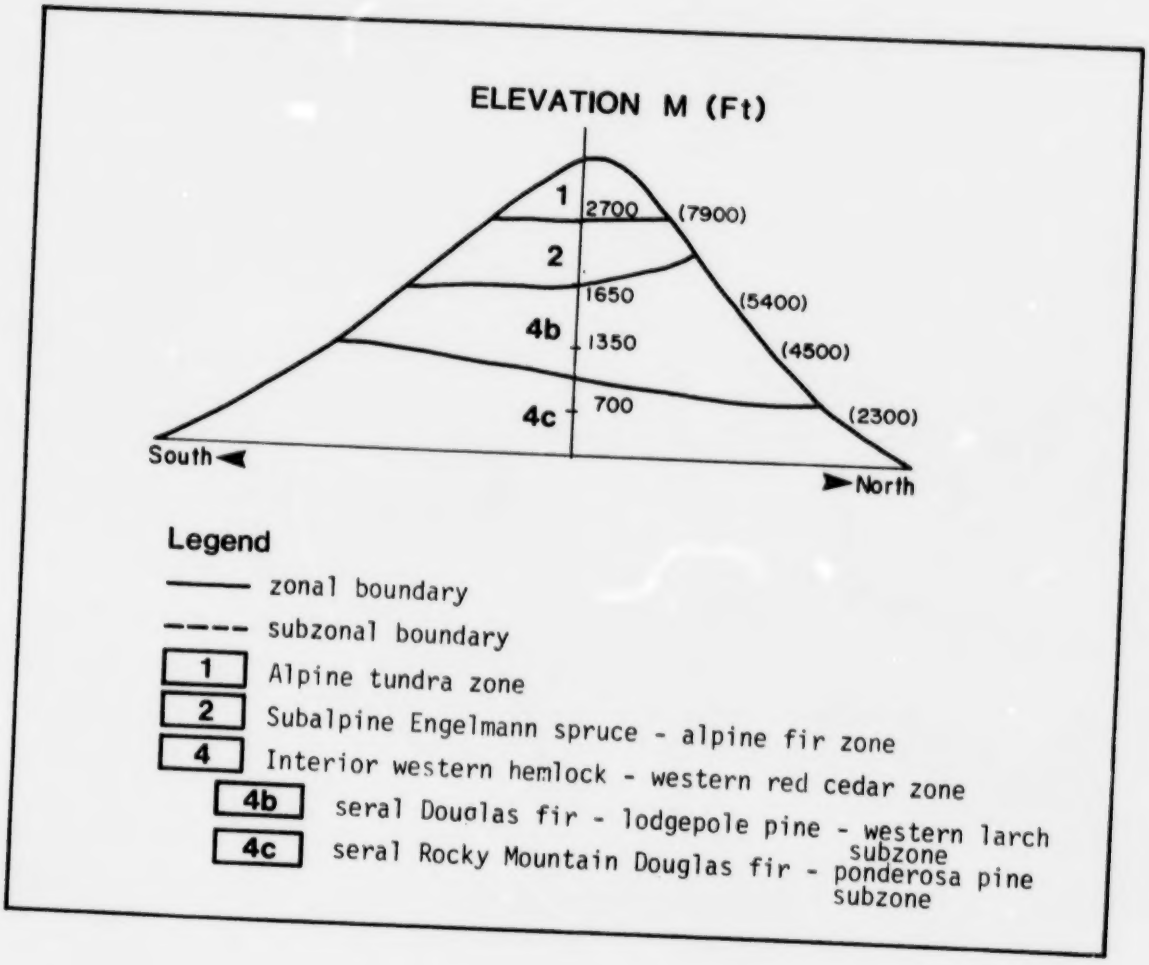


FIGURE 8: TYPICAL PATTERNS OF ZONES AND SUBZONES OF THE NELSON SECTION

The Nelson Section is found along the Columbia River from South Slocan to Queens Bay and towards the Arrow Lakes and northwards in the Slocan River Valley as far as Lemon Creek.

This Section reflects slightly cooler temperatures and greater precipitation than the previous section. This Section is distinct from the former in that the Interior grand fir-western red cedar zone does not occur, although on dry, exposed sites (edaphic) grand fir may occur.

Within this Section ponderosa pine generally occurs as a seral species to Rocky Mountain Douglas-fir or western hemlock and western red cedar. The forest stands are usually closed and grasses are uncommon in the understory.

In this Section sufficiently high temperatures permit the occurrence of ponderosa pine as a seral species in the Interior western hemlock-western red cedar zone and the occurrence of Rocky Mountain Douglas-fir as a seral species in the lower parts of the Subalpine Engelmann spruce-alpine fir zone.

Trout Lake Section

The Trout Lake Section is associated with the extensive mountainous areas. The predominant vegetative pattern in these areas reflects cold air drainage and pooling from the high elevations. This section is characterized by the occurrence of alpine fir and Engelmann spruce as seral species in the upper parts of the Interior western hemlock-western red cedar or more commonly the Interior western hemlock zone. The latter zone is also typically encountered in these cooler areas. In addition to the higher precipitation, the area reflects greater effective moisture. Within this section the upper limit of the Interior western hemlock zone or the Interior western hemlock-western red cedar zone (or as mapped Interior western hemlock-western red cedar complex) may extend up to 6500 ft. (2000 m), since early snows usually remain and provide sufficient insulation of the soil (Krajina, 1969). Simultaneously the increase in effectiveness of soil moisture, cool temperatures and shorter growing season combine to prevent Rocky Mountain Douglas-fir from growing much above 4500 ft. (1350 m).

Trout Lake Section

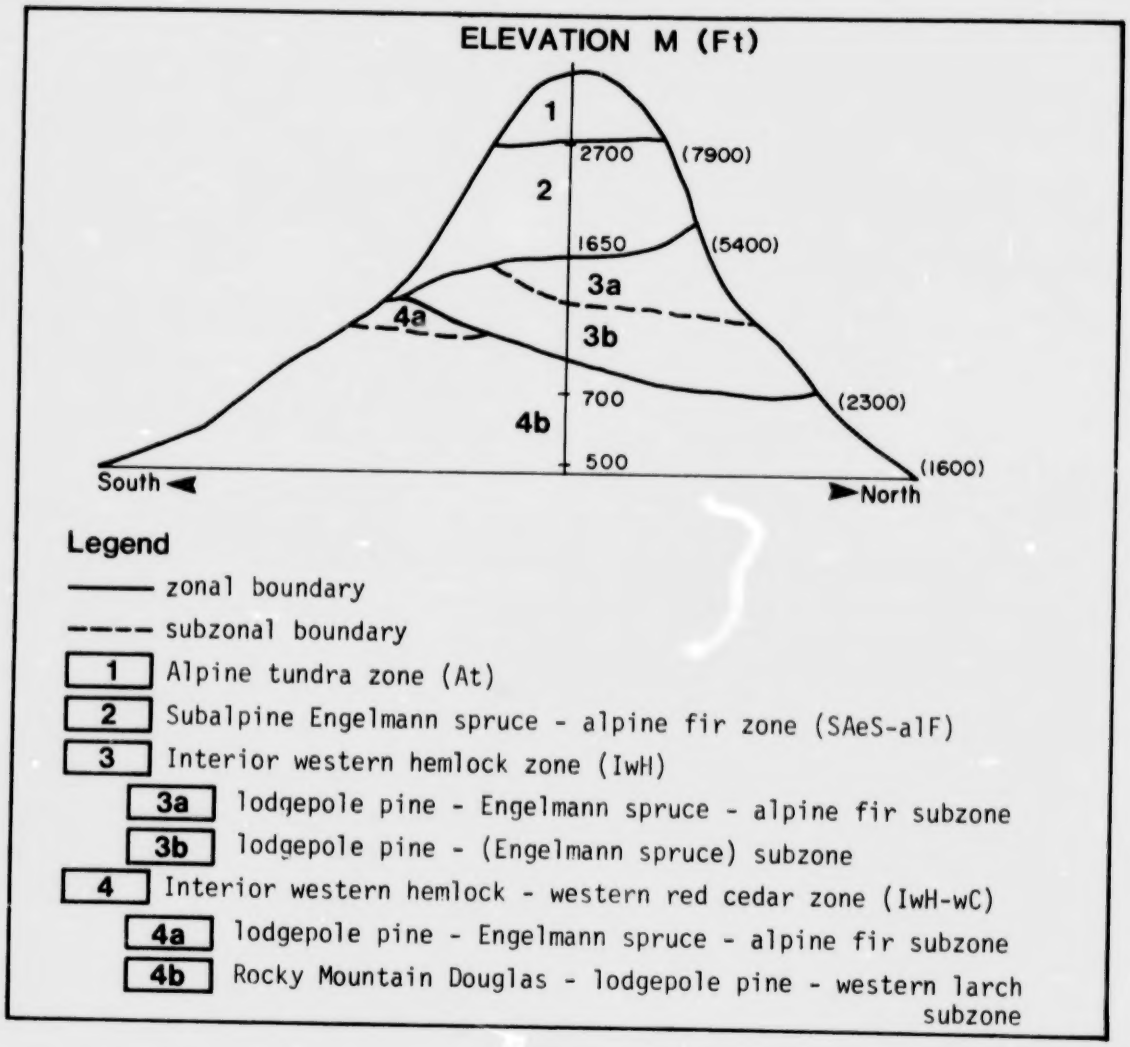


FIGURE 9: TYPICAL PATTERNS OF ZONES AND SUBZONES OF THE TROUT LAKE SECTION

The Forest Zones and Subzones

A forest zone is an area over which similar sites can produce the same dominant climax vegetation. Forest Zones are usually named after the climatic climax species that form the dominant canopy of well-drained, medium textured soils of modal soil chemistry. Different species may form the dominant (edaphic) climax canopy on sites of atypical soil moisture or soil chemistry.

A subzone is a subdivision of a zone, and can produce a unique combination of dominant seral species. A subzone is usually named after the characteristic seral species.

Forest zone and subzone patterns tend to correlate with climatic patterns, although they are also determined by the topography and soils of an area.

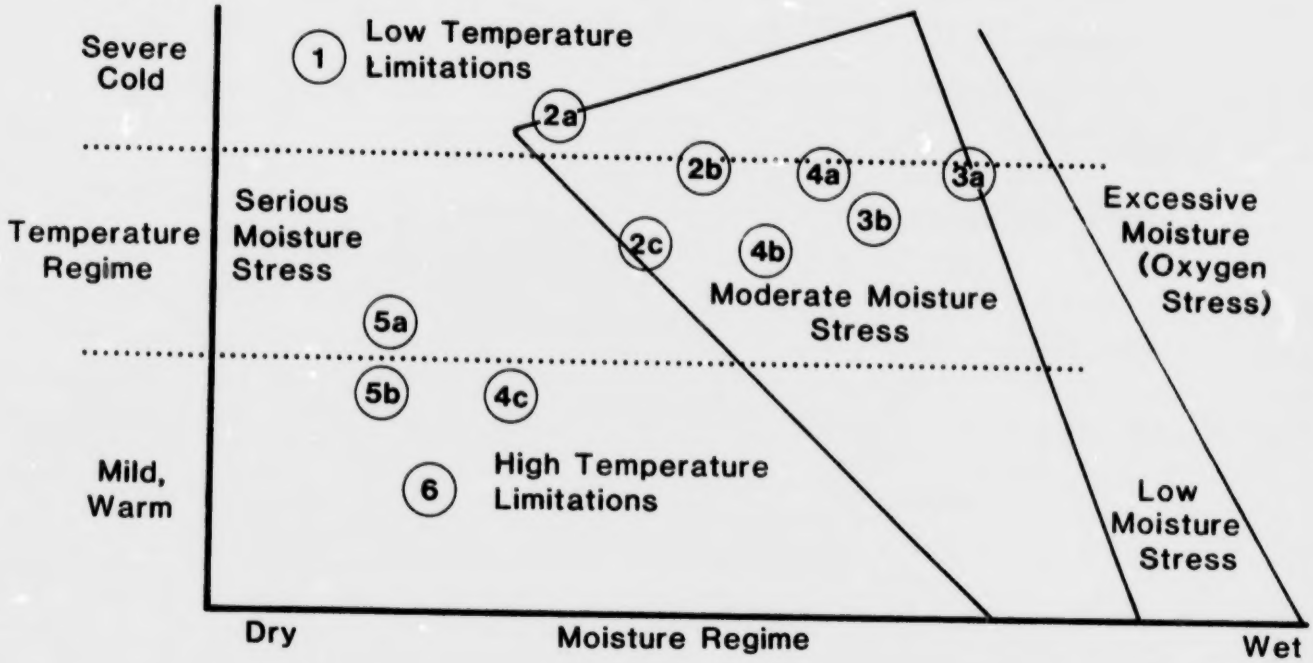


FIGURE 10: FOREST ZONES AND SUBZONES AND THEIR RELATIVE MOISTURE AND TEMPERATURE REGIME CHARACTERISTICS

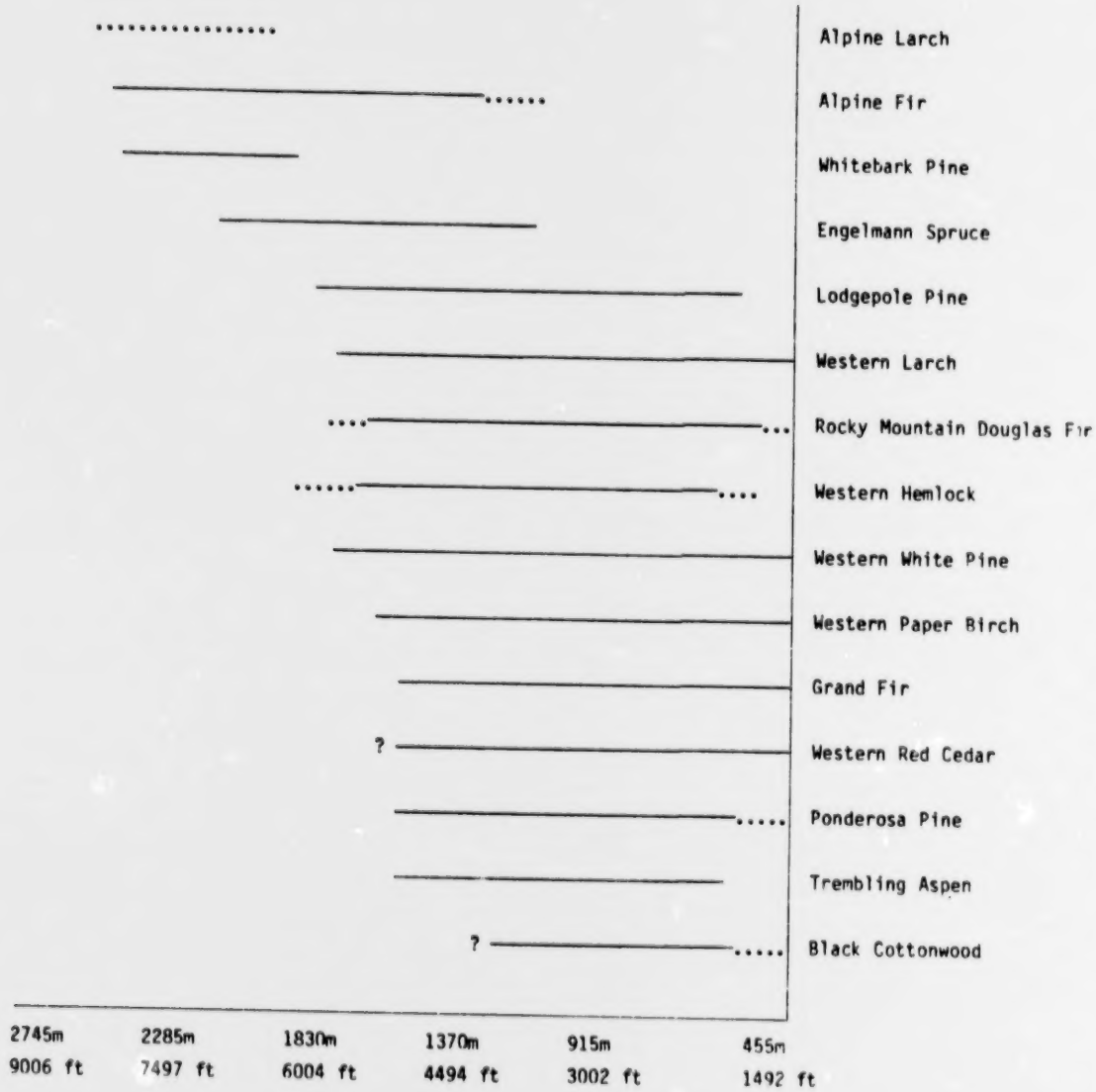
The altitudinal range of each of the major tree species of the area is presented in Figure 11. The described forest zones and (successional) subzones may be derived from this diagram if the following factors are taken into consideration. Some species do not occur in the same geographical area, and do not occur together to form a forest cover characteristic of a forest zone or subzone. Other species are sufficiently different in their habitat requirements that they will not occur together. For species that can occur together, competitive relationships (such as shade tolerance) determine if combinations of such species are characteristic of a zone or of a subzone.

Vegetation types typical for the zones of the Slocan Valley Planning Area are listed in Table 4. Detailed information on the plant species and the vegetation structure may be obtained from Vegetation Inventory and Interpretation of the Nelson Area (van Barneveld, in prep.).

The most important factors for the management of the vegetation are temperature regimes and moisture regimes.

Severe temperatures, short growing seasons and low growing temperatures adversely affect growth and regeneration. Such effects may be encountered in the Krummholz (2a) subzone and the lodgepole pine (2b) subzone of the Subalpine Engelmann spruce - alpine fir zone, in the lodgepole pine - Engelmann spruce - alpine fir (2a) subzone of the Interior western hemlock zone and in the lodgepole pine - Engelmann spruce - alpine fir (4a) subzone of the Interior western hemlock - western red cedar zone.

Severe moisture stress resulting from low soil moisture storage and possibly high evapotranspiration may delay revegetation and depress productivity. High surface temperatures may prove lethal for sensitive germinants. Rocky Mountain Douglas-fir - ponderosa pine (4c) subzone of the Interior western hemlock - western red cedar zone, and the Rocky Mountain Douglas-fir - ponderosa pine (b) subzone of the Interior grand fir - western red cedar zone may be subject to such conditions.



Legend

——— Altitudinal range based on recorded observation

..... Extended altitudinal range based on un-recorded observations

?——— Altitudinal range is expected to reach further than indicated - however no data or observations available

Figure 11: ALTITUDINAL RANGE OF THE MAJOR TREE SPECIES OF THE STUDY AREA

TABLE 4

CHARACTERISTIC VEGETATION TYPES OF THE SLOCAN VALLEY

Vegetation Zone	Vegetation Subzone	Vegetation Types[1]
Alpine tundra (At)		blue grass - anemone
Subalpine Engelmann spruce - alpine fir (SAef-alf)	krummholz	blue grass - anemone
	seral lodgepole pine, (no Rocky Mountain Douglas-fir; whitebark pine may be associated with upper parts of this subzone)	alpine fir - rhododendron - false hellebore - wood rush alpine fir - rhododendron - many-flowered one-sided wintergreen - green-stemmed pipecleaner moss alpine fir - rhododendron - broad-leaved arnica - foamflower Engelmann spruce - black blueberry - lady fern - violet Engelmann spruce - mountain alder - western bracken - false hellebore lodgepole pine - Engelmann spruce - Oregon boxwood - common western pipsissewa lodgepole pine - rhododendron - common pearly everlasting - hairy-cap moss
	Rocky Mountain Douglas-fir - lodgepole pine	Engelmann spruce - mountain alder - western bracken - false hellebore (not typical) (lodgepole pine, black blueberry - pinegrass and common moss are among typical vegetation)
Interior western hemlock (IWH)	lodgepole pine - (Engelmann spruce)	lodgepole pine - soopolallie - western bracken - red-stemmed pipecleaner moss lodgepole pine - Engelmann spruce - Oregon boxwood - common western pipsissewa western hemlock - alpine fir - black blueberry - evergreen yellow violet western larch - western red cedar - blue-bead clintonia - evergreen yellow violet western hemlock - western yew - devil's-club - oak fern western hemlock - devil's-club - blue-bead clintonia - foam flower western hemlock - western white pine - large-leaved rattlesnake orchid - common moss
	seral lodgepole pine - Engelmann spruce - alpine fir	alpine fir - western hemlock - rhododendron, blue-bead clintonia - foamflower Engelmann spruce - western hemlock - twistedstalk - green-stemmed pipecleaner moss western hemlock - Engelmann spruce - common lady fern - oak fern western hemlock - western white pine - large-leaved rattlesnake orchid - common moss lodgepole pine - Engelmann spruce - Oregon boxwood - common western pipsissewa western hemlock - alpine fir - black blueberry - evergreen yellow violet

TABLE 4 (Continued)

Vegetation Zone	Vegetation Subzone	Vegetation Types[1]
Interior western hemlock - western red cedar - (IwH-wC)	Rocky Mountain Douglas-fir - lodgepole pine - western larch	western hemlock - devil's-club - blue-bead clintonia - foam-flower western hemlock - western white pine - large-leaved rattlesnake orchid - common moss western red cedar - Utah honeysuckle - western yew - blue-bead clintonia western hemlock - Oregon wintergreen - blue-bead clintonia - green-stemmed pipecleaner moss trembling aspen - paper birch - western thimbleberry - western bracken lodgepole pine - soopolallie - western bracken - red-stemmed pipecleaner moss lodgepole pine - Engelmann spruce - Oregon boxwood - common western pipsissewa western larch - western red cedar - blue-bead clintonia - evergreen yellow violet
	Rocky Mountain Douglas-fir - ponderosa pine	Rocky Mountain Douglas-fir - snowberry - fairybells - pine grass complex Rocky Mountain Douglas-fir - rose - small reed grass - spreading dogbane trembling aspen - paper birch - western thimbleberry - western bracken
Interior grand fir - western red cedar (IgF-wC)	Rocky Mountain Douglas-fir - ponderosa pine	Rocky Mountain Douglas-fir - snowberry - fairybells - pine grass complex western red cedar - Utah honeysuckle - western yew - blue-bead clintonia

[1] The vegetation types are extracted from: Vegetation Inventory and Interpretations of the Nelson Area (van Barneveld, in preparation).

Wetter and cooler areas are more prone to nutrient losses from the soil than are their drier counterparts.

Insufficient oxygen, which restricts the normal function of the plant roots, occurs sporadically. For the majority of the excessively wet sites, soil moisture is sufficiently oxygenated.

3.2.2 Succession

Succession is the natural process by which plant communities are replaced by new communities under influence of self-induced changes of the site environment. These modifications may consist of temperature and humidity changes or changes in light availability under the shading influence of the newly growing vegetative cover to substantial changes in soil moisture and soil nutrients under influence of leachates from an accumulation of organic litter on the forest floor. Climate, vegetation structure and soil conditions are the most important factors controlling natural succession.

Alpine Tundra Zone

Succession is extremely slow. Soil and climate modification occur very slowly as biomass production (and consequently litter build-up) is low, decay rates are very low and the vegetation remains close to the surface.

Lichens, and in more hospitable locations, mountain-avens are the early pioneers preparing the sites eventually for bunchgrasses, hardy dwarfshrubs and succulents, heaths or alpine meadow plants.

Subalpine Engelmann Spruce - Alpine Fir Zone
Krummholz Subzone

Succession in the krummholz subzone proceeds very slowly and intermittently. The severe climate is marginal for growth of subalpine species, and these species establish only in periods of milder than average climatic

conditions. In harsher periods succession comes to a halt or vegetation may even be killed. In early stages succession proceeds at a similar rate as in the Alpine Zone. However once the subalpine vegetation gains a foothold succession proceeds somewhat more rapidly. Climate modification occurs more readily in the taller and denser subalpine vegetation. Under influence of high precipitation soils are leached more rapidly since organic matter is broken down more readily. Accordingly succession proceeds from pioneering alpine meadow plants through a stage of subalpine meadows and mountain-heather to a stunted and contorted forest of alpine fir.

Lodgepole Pine Subzone

Succession in this subzone proceeds from relatively slow under influence of severe climatic limitations in the upper parts of this subzone to rapid in lower parts of the subzone, where soils are well expressed and climatic conditions are near optimum for lodgepole pine, Engelmann spruce and alpine fir.

Towards the upper limit of this subzone bear-grass and black blueberry may form a dense cover interfering with the establishment of tree species. Succession proceeds slowly towards a thicket of poorly growing alpine fir with rhododendron and black blueberry in the understorey.

In intermediate areas lodgepole pine and grouseberry with sparse alder, and Pacific menziesia preceeds a climax of alpine fir, Engelmann spruce and moss on sites of lower productivity while on the better sites white-flowered rhododendron may abound in early seral stages as well as under the climax canopy.

Abundant moisture on the most productive sites may create an overabundance of rich site plants such as devil's-club, lady fern and foamflower, which may delay establishment of productive tree species, predominantly Engelmann spruce. In the earlier stages of succession the reduced water consumption by trees may result in the emergence of free surface water.

Thin-leaved mountain alder and Sitka mountain alder may pioneer and dominate on these sites.

Rocky Mountain Douglas-fir Subzone

This subzone is characterized by somewhat higher energy (heat units) input and consequently by higher moisture deficits. Succession in this subzone is driven by the cooling effects under influence of shading by established vegetation. Under influence of the formation of a continuous moss layer soil temperatures decrease while soil moisture availability increases. The soils are generally moderately leached and weathered to a moderate depth. On these moderately rich soils black blueberries, dwarf blueberries, pine grass, arnica, showy asters, willows and Sitka mountain alder under a canopy of lodgepole pine will follow the early seral stages of fireweed and Sitka mountain alder.

Interior Western Hemlock Zone

Lodgepole Pine - Alpine Fir Subzone

This subzone is characterized by abundant moisture availability, deeply weathered acidic soils and cool temperatures. Following removal of the vegetation (by fire or cutting) little change occurs, somewhat more extreme temperatures, being significant. However growth conditions remain very favourable for lodgepole pine, alpine fir and Engelmann spruce, which are the typical seral species. On richer sites (usually more loamy textured soils) the understory of successional stands may be formed of a vigorous dense stratum of Oregon-boxwood, twinberry honeysuckle and white-flowered rhododendron to rich moisture loving communities including currants, western meadow rue, foamflower, lady-fern and devil's-club. Under the closed climax canopy of western hemlock, white-flowered rhododendron, simple-stemmed twistedstalk, and rhytidiopsis moss commonly remain, be it in much lesser quantities.

Lodgepole Pine Subzone

This subzone is characterized by cool and moist conditions and deeply weathered acidic soils. Microclimatic modification following removal of the vegetative cover is insignificant, slight moisture deficiencies being the most prominent controlling force of succession. Air drainage in this subzone is generally good. Nutrient deficiencies in the deeply weathered soils combined with the slight moisture stress limit the success of alpine fir and Engelmann spruce. Typically under a canopy of lodgepole pine, western white pine and western hemlock, Oregon boxwood, blue-bead clintonia and rhytidiopsis moss flourish. As climatic moisture deficiencies are slight, excessive moisture is frequently found in depressions and gullies. Engelmann spruce, western red cedar and many of the previously mentioned moisture-loving plants may ocur here. Because of more favourable temperature/energy regimes, these sites may be among the most productive forest sites.

Interior Western Hemlock - Western Red Cedar Zone

This zone is distinct from its counterpart in the Interior western hemlock zone by virtue of less deeply weathered soils and a somewhat lower moisture efficiency (usually because of lower precipitation). A somewhat higher base status of the soils occurs within the rooting zone.

Lodgepole Pine - Alpine Fir Subzone

This subzone is characterized by cool temperatures and moderate precipitation. Soils have a reasonable base status within the rooting zone. Following removal of the vegetative cover microclimatic modification results in more severe temperatures, and somewhat increased soil moisture deficiencies. Soils may freeze earlier in the fall.

Succession in this subzone generally reflects the somewhat higher base (and often nutrient) status and varies with available soil moisture. Western larch, lodgepole pine, Engelmann spruce, trembling aspen and alpine

fir are characteristic seral tree species. The understorey varies strongly with depth of weathering, nutrient content and soil moisture condition. Dry nutrient poor sites may display an abundance of grouseberry, while willow, blue-bead clintonia, black blueberry, Oregon-boxwood, and twinberry honeysuckle will commonly occur on better sites. Rich seepage sites may display a dense "sod" of lady-fern, oak fern, cucumberroot twistedstalk, western meadow-rue, devil's-club under a canopy of Engelmann spruce, or western red cedar and western hemlock.

Rocky Mountain Douglas-fir - Western Larch Subzone

This subzone is characterized by moderate temperatures and significant moisture deficiencies. Soils are generally weathered to moderate depth and claypans may have formed. The relatively shallow rooting area above the claypan serves to store moisture. However higher temperatures result in considerable evapotranspiration, readily exhausting the limited supply of stored moisture. Significant moisture deficiencies occur. Depending on the degree of weathering and leaching of the soils (reflected in soil pH) the minor vegetation of seral stands may include pine grass and saskatoon, Oregon boxwood, thimbleberry, northern twinflower and common moss or willows, black blueberry and pearly everlasting. The overstorey of such stands may include Rocky Mountain Dougals-fir, trembling aspen, western larch, lodgepole pine, and western white pine. Various proportions of western red cedar, western hemlock and common paper birch may occur.

Ponderosa Pine Subzone

This subzone is subject to high temperatures and severe moisture deficiencies. Soils are only shallowly weathered. On dry exposed soils lime accumulations may occur at shallow depth. High surface temperatures and severe moisture deficiencies may inhibit revegetation. However precipitation in this subzone is sufficient to permit western red cedar and western hemlock to form the climax. This can happen only after considerable modification of surface temperatures and moisture effectiveness under influence of

a tree canopy. Initial revegetation may be slow, until a vegetative canopy has formed. Early stages of succession are characterized by bluebunch wheat grass, Idaho fescue, redstem ceanothus and snowberry under an open canopy of Rocky Mountain Douglas-fir and ponderosa pine. Oceanspray, western red cedar, common paper birch, ninebark and pine grass may also occur. Towards the climax western red cedar, western hemlock, grand fir, wild sarsaparilla, blue-bead clintonia, rose, western fescue and pleurozium moss may become components of the vegetation.

Interior Grand Fir - Western Red Cedar Zone

This zone results in response to long and warm growing season, mild winter conditions, and severe moisture deficiencies during the summer. Soils tend to be weathered shallowly. Grand fir and western red cedar form the tree canopy with northern twinflower, Oregon boxwood, common western pipsissewa and pleurozium moss in the understorey.

Ponderosa Pine Subzone

Succession in this subzone is controlled by severe moisture deficiencies,high surface temeratures and a low nutrient budget for shallow rooted plants. Under these conditions succession initially proceeds very slowly. However, sufficient moisture is available for relatively rapid plant establishment and growth once surface temperatures are reduced by the established vegetation. Early seral vegetation may include Rocky Mountain Douglas-fir, ponderosa pine, California filbert, fairybells and wild sarsaparilla. Towards the climax grand fir, western red cedar, western fescue, northern twinflower and common moss are regular components of the vegetation.

The relationship between vegetation and some of the soils of the study area is presented in Appendix 2. This table may be used in conjunction with the soils map to estimate the range of vegetation that may occur on each soil. An estimation of the range of vegetation that can occur on the soils mapped for 82 K/SW may be obtained by comparing these soils with those

mapped for 82 F/NW and SW. If a soil of the first mapping area is similar to a soil of the latter mapping area with respect to:

a) forest zone (and altitude)
b) parent material
c) dominant subgroup development
d) significant subgroups and phase(s)

then it is reasonable to expect a similar range of vegetation. The vegetation type numbers correspond to those of Appendix 3. Complete information on the species composition and environmental requirements of each of the vegetation types may be obtained from Terrestrial Studies Branch.

3.3 THE CLIMATE OF THE SLOCAN VALLEY

The climate of an area is the expression of its weather conditions over an extended period of time. Where the types, persistency, and frequency of weather are similar there exists a unique regional climatic character.

Although the entire study area is subjected to the same weather systems and exhibits a single broad climatological character, a wide variety of sub-regional and local climates occur within its boundaries. Identification of these climates is important if resource planning and management are to be optimized.

The physical presence of the Western Cordillera has a great influence on the climate of western Canada. These mountains limit the mild, humid air from the Pacific to a narrow band along the coast. With the prevailing westerly atmospheric circulation, coastal air is forced over the successive mountain ranges and compelled to precipitate its moisture on the west facing slopes.

East of the Coast mountains in British Columbia, much of the moisture has been condensed out of the lower layers of the atmosphere. However, the air is not especially dry since substantial volumes of moist air penetrate through the deep valleys of the Coast Mountains and over the lower parts of

the ranges. Because of the lifting process, the west facing slopes of the upland areas receive considerably more precipitation than do east slopes and valley locations. As the air is forced over each successive mountain barrier, the relative precipitation totals decrease until the Selkirk Mountains are confronted. Here, on the west facing slopes, occurs the greatest precipitation totals in the British Columbia interior.

The Slocan valley trends north and south through the Selkirk Mountains. The climatological character of the region is relatively wet and continental in nature with cold winters and warm summers. During winter months, cold air masses frequently move down the valley from the northern portions of the Province. Occasionally, extremely cold air advects into the area from Alberta by way of the Rocky Mountain passes or by subsidence from higher elevations. During the summer, hot days are frequent and cool nights typical.

The Slocan valley is narrow, well contained and exhibits a topographically restricted outflow area. Although subjected to the same air mass movements as the rest of the region, under some synoptic conditions the penetration of warmer air into this valley may be retarded or the cool air trapped while more open areas such as the Columbia River valley warm quickly through the purging and mixing of the cool air. Over time, these subregional influences of topography on weather systems create a subtle shading to the broader regional climatic character and can be described as subregional climates.

Regional and local climates must usually be dissected and described as individual climatological elements, but it must be emphasized that, even though some elements may have a greater impact on any particular local climate, it is the interaction and total expression of these elements that creates the climate. It is this total expression which so greatly influences local soil and hydrological characteristics and the distribution of flora and fauna.

Since most climatological elements vary significantly with elevation, slope, and aspect, it is the high, rugged relief of the study area which has enabled the creation of a myriad of local climates. The importance of these factors cannot be over-emphasized when considering the climate of the study area.

Solar Radiation

Solar radiation is the most important of climatic elements. As the primary source of the earth's energy, it powers atmospheric circulation, drives the hydrologic cycle and sustains biological systems. It varies greatly with latitude, slope, aspect and season as demonstrated in Figure 12. A level site in the Slocan valley not subjected to topographic shading is estimated to receive 4270 MJ/m^2 of radiant energy in the average year. This represents about 47% of the energy received at the top of the atmosphere directly above the area. Although the average daily solar radiation is 11.7 MJ/m^2 over the year, July averages 22.9 MJ/m^2/day and December only one tenth of July's average.

Solar radiation is greatest on south facing slopes which remain unshaded by local topography and usually results in higher ambient temperatures, reduced snow cover, and reduced soil moisture relative to other sites.

Sunshine

The study area averages about 1800 hours of bright sunshine in a year which is 37% of the total possible. July is the sunniest month and averages 300 hours or 62% of the daylight hours. December, the month of winter solstice, is the least sunny averaging only 30 hours or 12% of the total possible hours.

FIGURE 12: RELATIVE SOLAR RADIATION RECEIVED BY VARIOUS SLOPES AND ASPECTS ON JUNE 22, DECEMBER 22 AND ANNUALLY AT 50° NORTH LATITUDE.

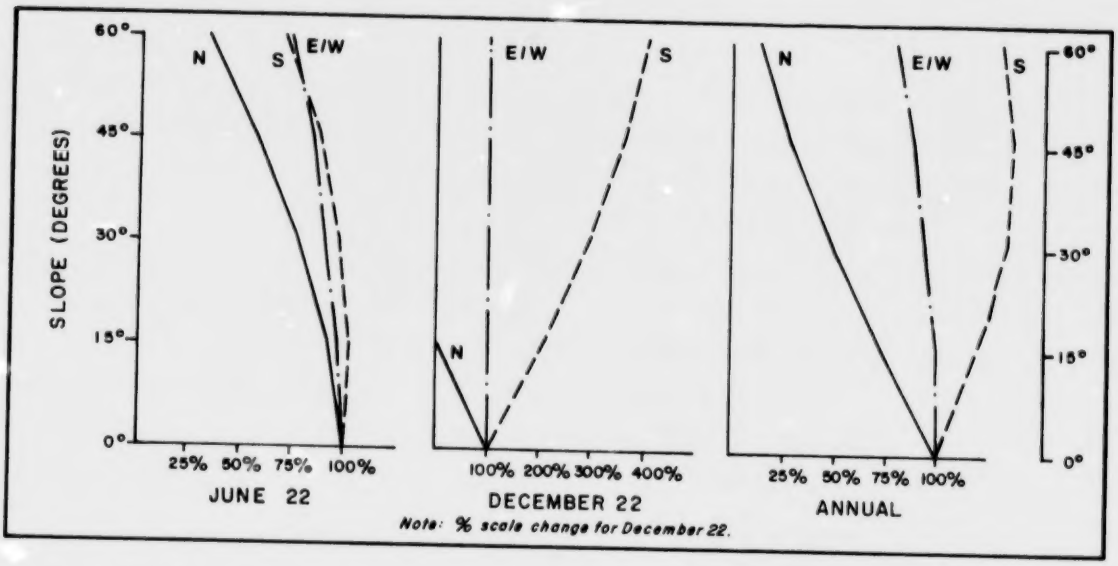
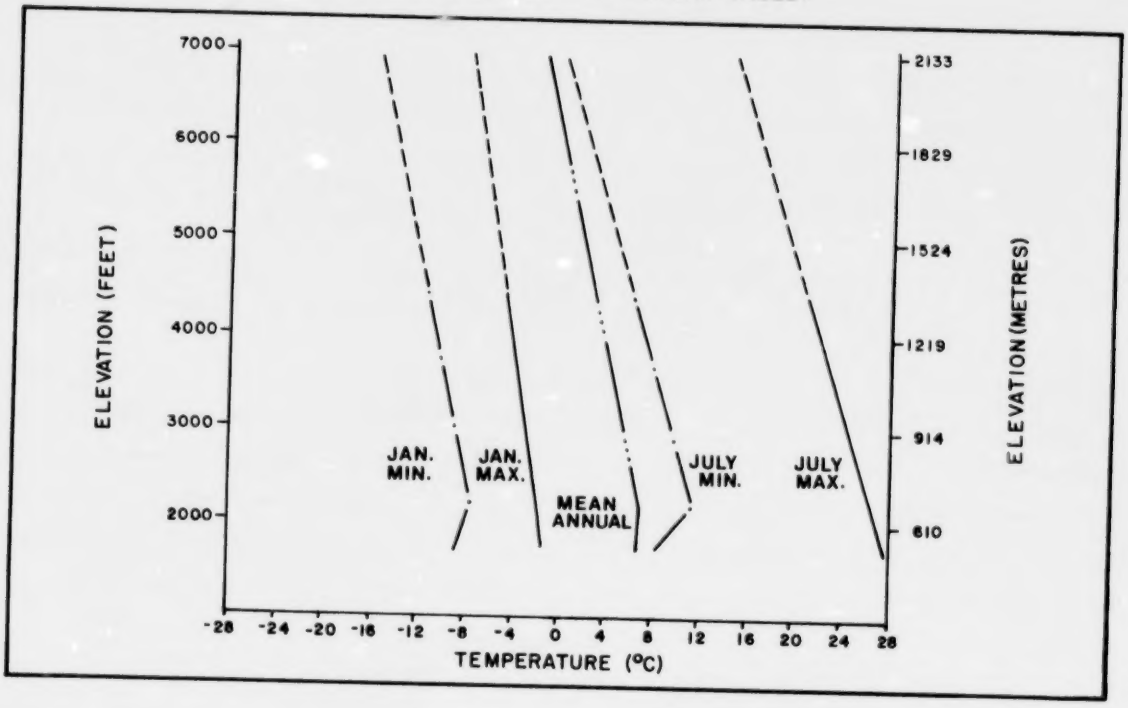


FIGURE 13: RELATIONSHIP OF MEAN ANNUAL TEMPERATURE, AND MEAN JANUARY AND JULY MAXIMUM AND MINIMUM TEMPERATURES TO ELEVATION IN THE SLOCAN VALLEY



Temperature

Maximum and minimum temperatures and diurnal temperature fluctuations reflect the continental nature of the region. Mean daily maximum and minimum January temperatures of -.15°C (31.7°F) and -8.7°C (16.3°F) respectively are typical for valley bottom sites. Comparable values in July are 27.8°C (82.0°F) and 8.3°C (46.9°F). The most extreme temperatures recorded in the area are -34°C (-29°F) in January and +40°C (104°F) in July.

As a rule, temperatures decrease rapidly with increasing elevation and decreases at a rate which varies between day and night and between months and seasons. This relationship is demonstrated in Figure 13. Because of the collection of cooler air in low lying areas, minimum temperatures commonly increase with increasing elevation for a short distance above such sites. The more typical trend occurs at elevations which are beyond the influence of this air pooling. As a consequence, the highest minimum temperatures are to be found around 2200' (670 metres) along the lower slopes of the Slocan and Little Slocan River valleys.

Areas lying close to Slocan Lake have slightly moderated temperatures throughout the year. During the summer months minimum temperatures are higher and maximums lower than low elevation sites in other parts of the valley. During the winter Slocan Lake usually remains unfrozen and acts as a source of heat to maintain higher maximum and minimum temperatures on nearby sites.

Freeze Free Period

Freeze free periods vary greatly with topography, elevation, and site exposure but are usually the longest on well drained slopes at the lower elevations. Valley bottom sites exhibit reduced freeze free periods due to the collection and stagnation of radiationally cooled air. Crescent Valley has an average freeze free period of 97 days while the better drained site at South Slocan averages 140 days. Freeze free periods fall to less than 30 days above 6000' (1828 metres) (Figure 19).

Potential Evapotranspiration

Potential evapotranspiration (PET) is the amount of moisture which if available, would be transferred to the atmosphere from a given area of land by the combined effect of evaporation and plant transpiration. PET quantifies the radiation and thermal characteristics of an area and is greatest where ambient temperatures and solar radiation values are highest.

May through September is the period when most of the annual PET total is accumulated. During this period South Slocan averages 586 mm (23.0 in.) of PET, Crescent Valley 562 mm (22.1 in.), and New Denver 455 mm (17.9 in.). A level site at 5000' (1524 metres) in the south central portion of the study area is expected to have about 345 mm (13.6 in.) of PET over the same period (Figure 13).

Since PET is a function of radiation, temperature, wind and vapour pressure deficit, seasonal totals decrease with increasing elevation, deviation of aspect away from southwest, changing slope away from an optimum and, to a lesser extent, with increasing latitude. Thus low elevation, south and southwest facing slopes along the Slocan and Little Slocan River valleys, and near the mouth of Enterprise, Springer, Lemon, Silverton, Trozzo and Winlaw Creeks have the greatest PET values. Comparable values will not be found on similar slopes in Gwillim, Evans and Nemo Creeks because of topographic shading during the warmest part of the day.

Precipitation

Precipitation patterns in the region exhibit much local variability but gradients of increasing precipitation generally run southwest to northeast. West facing slopes receive considerably more moisture than east facing slopes at the same elevation. The low elevations of the Slocan and Little Slocan River valleys are situated leeward of the Valhalla Ranges within a local rainshadow. Lesser amounts of precipitation fall south of Slocan Lake; the driest local area being Passmore with a seasonal total of 180 mm

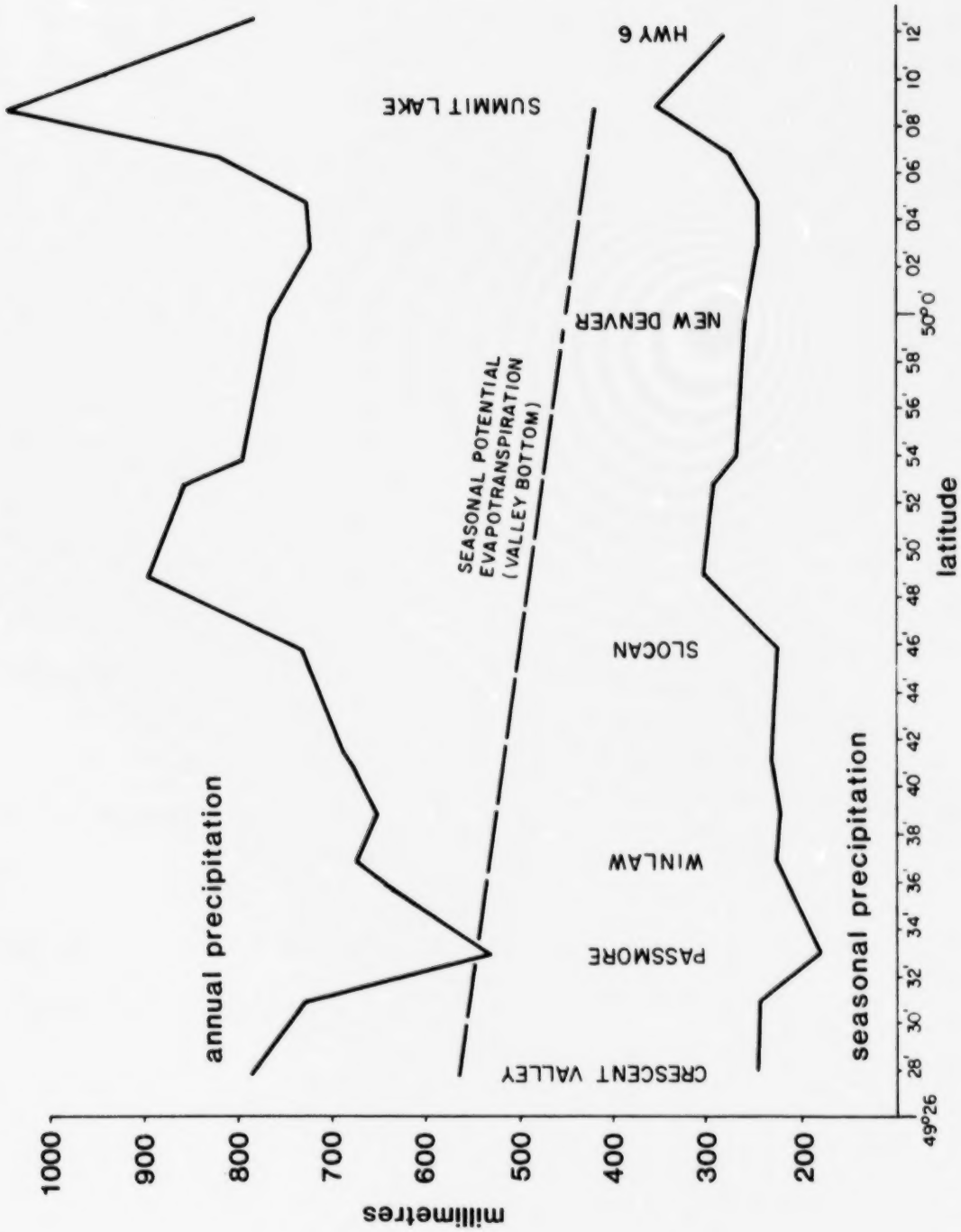


FIGURE 14: VALLEY BOTTOM SOUTH TO NORTH TREND OF SEASONAL POTENTIAL EVOPOTRANSPIRATION

(7.08 in.) and an annual total of 535 mm (21.06 in.). Precipitation gradually increases north of Slocan. Valley bottom precipitation is greatest at Summit Lake where the total seasonal precipitation is 355 mm (13.97 in.) and total annual precipitation is 1050 mm (41.33 in.) (Figure 14).

Precipitation increases greatly with increasing elevation; the seasonal rate being 84 mm (3.3 in.) per 1000' and the annual increase being 235 mm (9.25 in.) per 1000'. Above 5000' (1524 metres) these rates of increase are possibly reduced.

Precipitation is fairly evenly distributed throughout the year with 61 % to 63% of the annual total falling between October and March. Rain is common in all months with peaks occurring in the May-June period and in October. Snowfall makes up 25-40% of the annual total precipitation at low elevations and up to 80% at higher elevations.

Climatic Moisture Balance

The Climatic Moisture Balance (CMB) expresses the difference between the average seasonal precipitation and average seasonal PET. It is a description of purely climatological phenomena and does not consider the actual moisture regime of the soils in any particular area. Calculation of the CMB provides either an indication of the quantity of moisture potentially available to the soil and vegetation over the growing season (a Climatic Moisture Surplus - CMS) or the degree of climatically induced water deficit the site may be subjected to over the same period (Climatic Moisture Deficit - CMD).

Because CMB is a function of PET and precipitation, Climatic Moisture Deficits decrease southwest to northeast with increasing elevation, with change of aspect towards the northeast and with change in slope away from the optimum for solar heating. Consequently, Climatic Moisture Surpluses increase in the same manner.

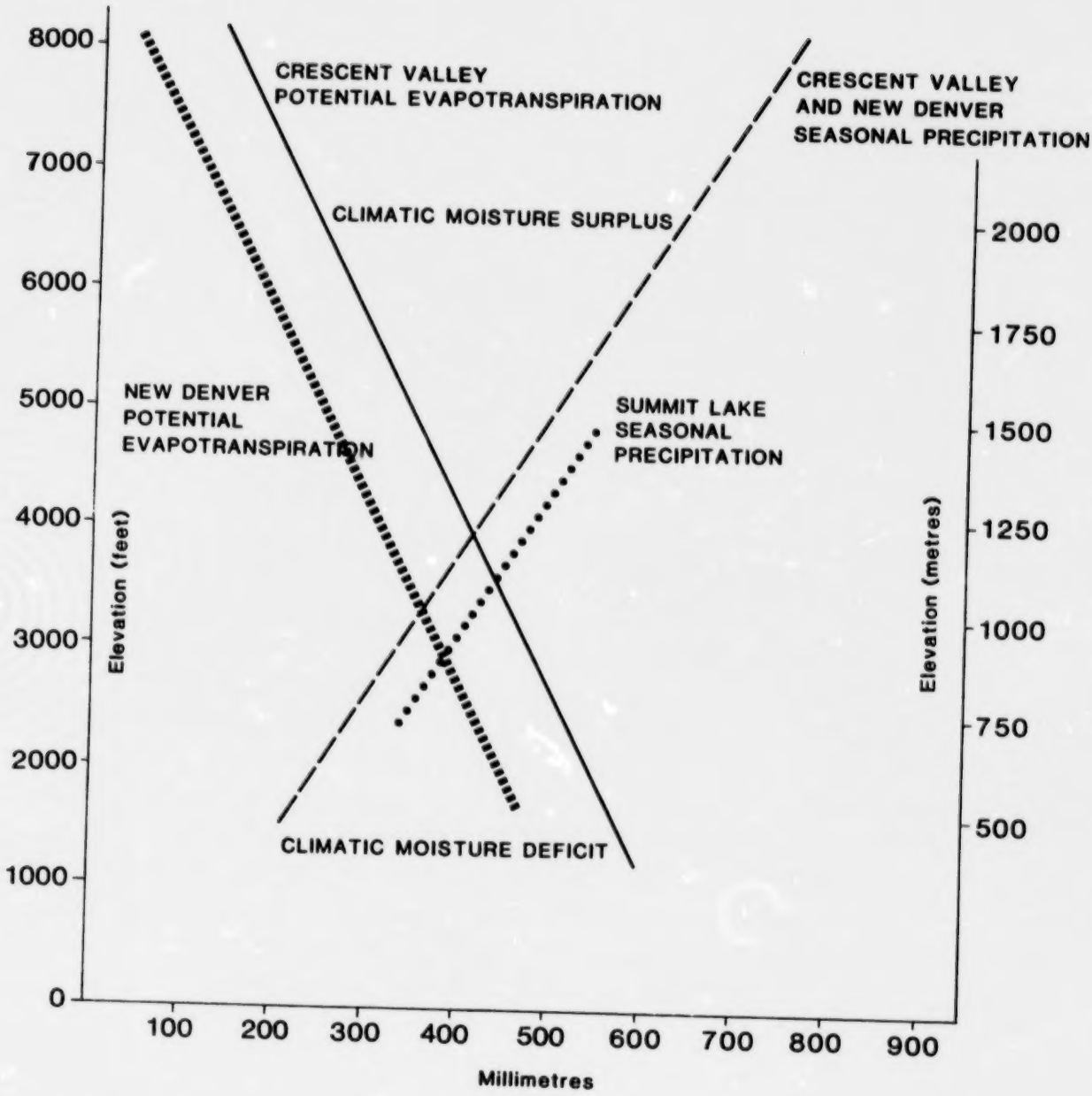


FIGURE 15: RELATIONSHIP OF SEASONAL PRECIPITATION, POTENTIAL EVAPOTRANSPIRATION AND CLIMATIC MOISTURE BALANCE WITH ELEVATION ON A LEVEL SITE NEAR CRESCENT VALLEY, NEW DENVER AND SUMMIT LAKE

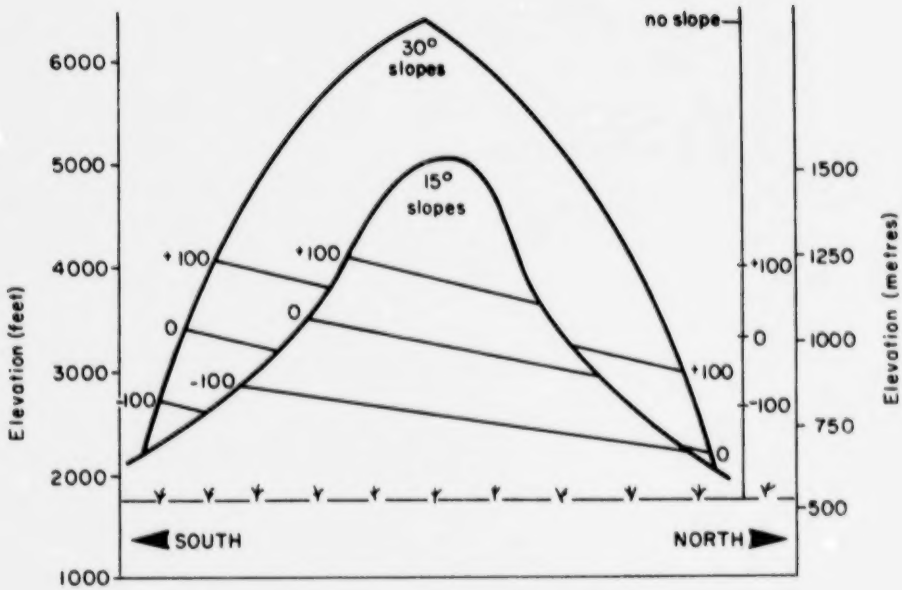


FIGURE 16: RELATIONSHIP OF CLIMATIC MOISTURE BALANCE WITH ELEVATION FOR 15° AND 30° SLOPES FOR NEW DENVER

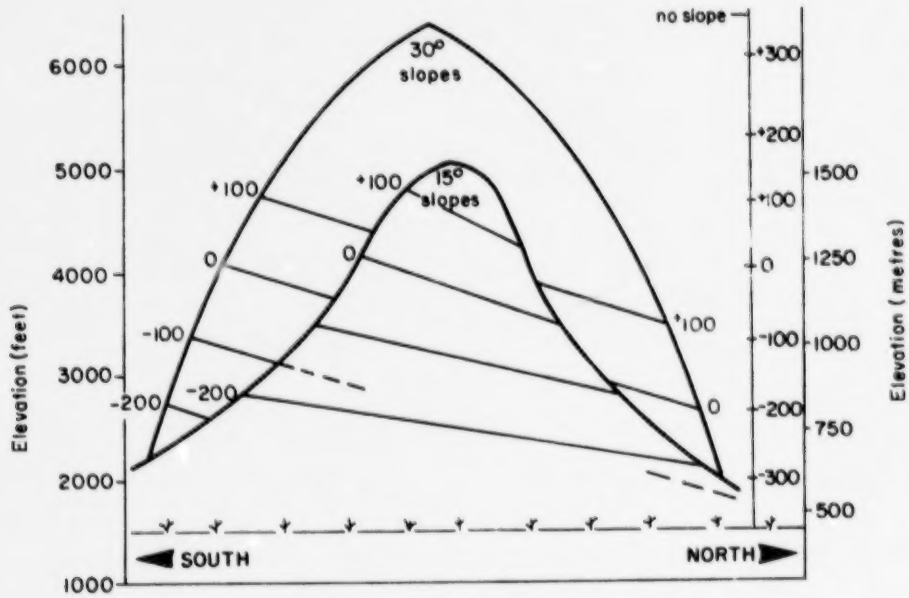


FIGURE 17: RELATIONSHIP OF CLIMATIC MOISTURE BALANCE WITH ELEVATION FOR 15° AND 30° SLOPES FOR CRESCENT VALLEY

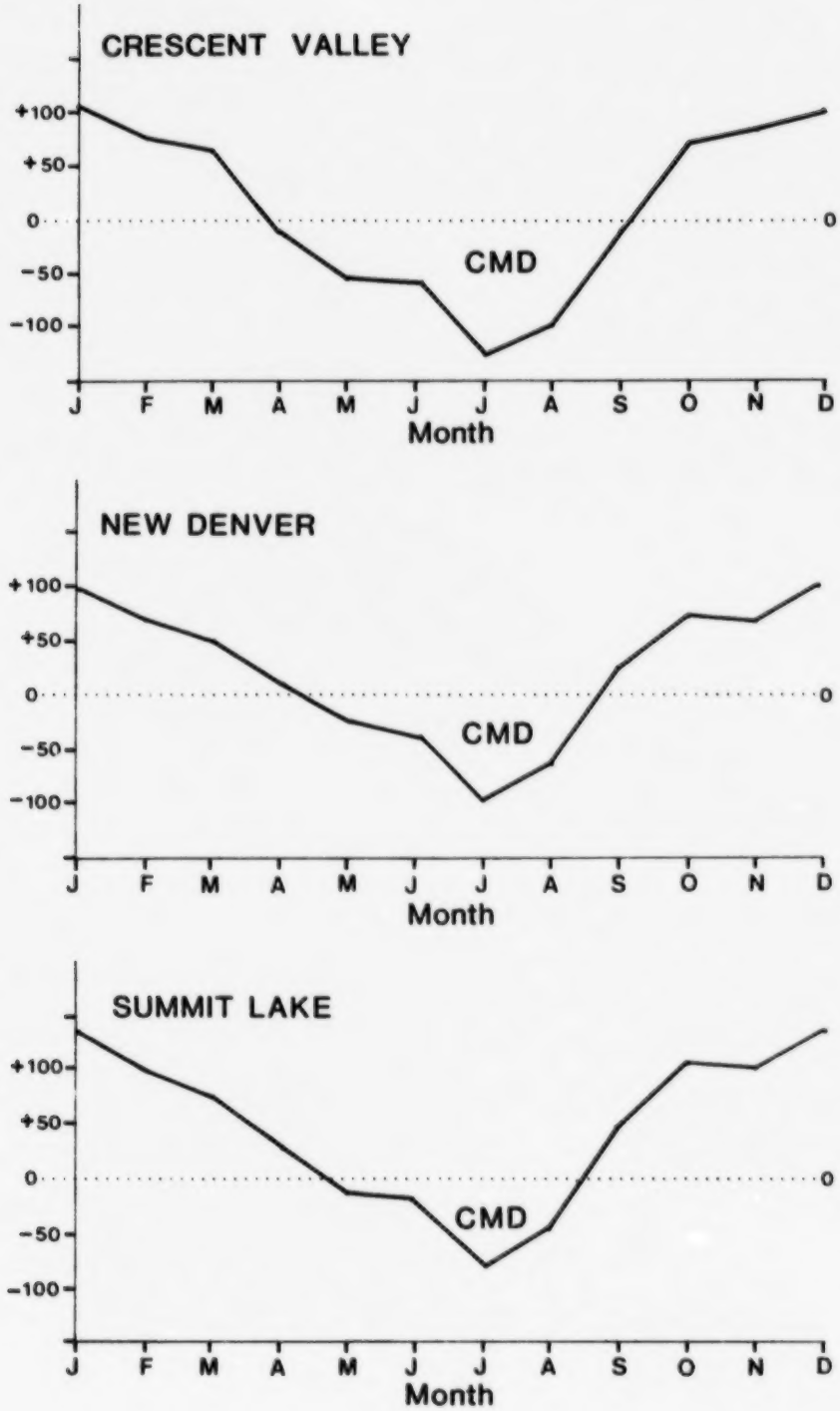


FIGURE 18: MONTHLY RELATIONSHIP OF CLIMATIC MOISTURE BALANCE FOR CRESCENT VALLEY, NEW DENVER AND SUMMIT LAKE

A seasonal CMD of 343 mm (13.5 in.) occurs at South Slocan but this decreases to 120 mm (4.7 in.) at Summit Lake. In the southern portions of the study area CMD is reduced to zero at about 4000' (1210 metres). Above this elevation there is an increasing CMS which is estimated to be 155 mm (6.1 in.) at 5000' (1524 metres) (Figures 15, 16 and 17). The period over which a seasonal CMD normally occurs is reduced with increasing latitude and increasing elevation. At Crescent Valley this period is typically 5.2 months while at Summit Lake it is reduced to 3.7 months (Figure 18).

Snow

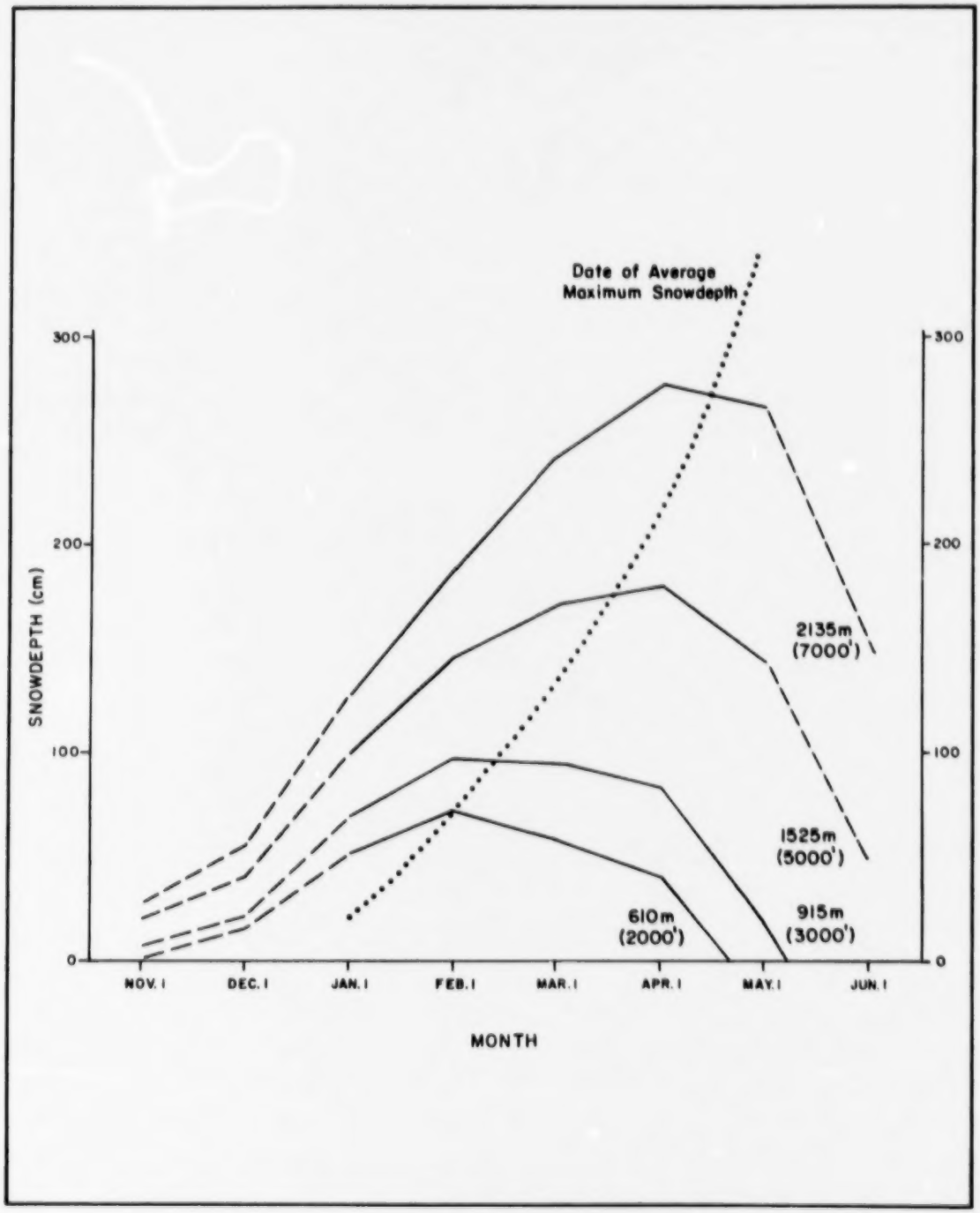
The distribution and abundance of snow is of great hydrological importance to the area. Generally snow cover begins earliest, lasts longer and reaches greater depths at the higher elevations. There is some increase in snowdepth from south to north over the study area but a lack of local data makes this very difficult to quantify.

Snow accumulation begins at high elevations in early October and at progressively lower elevations as the mean atmospheric freezing level lowers. Snow accumulation usually begins in valley bottom locations by mid-November. During late winter and spring the process is reversed with the complete ablation of snow occurring in the valley bottom site by early April and by early July at high elevations.

Average maximum snow depths in valley bottom locations are up to 60 cm and are realized by late January or early February. At 7000' (2133 metres) average maximum snow depths range from 280 to 345 cm (9.2 to 11.3 ft.) and occur by mid-April. Figure 19 illustrates the relationship of snow depth to elevation.

Snow density increases at all elevations as the snow season progresses. There is no appreciable difference at different elevations in any particular month. Average snow density increases from 0.2 gm/cc (12.48 lb./cu.ft.) in November, through 0.3 gm/cc (18.72 lb./cu.ft.) in early February to 0.492 gm/cc (30.71 lb./cu.ft.) on June first.

FIGURE 19: SNOWDEPTH BY MONTH OF SELECTED ELEVATIONS FOR SOUTH AND CENTRAL SLOCAN VALLEY AND DATE OF AVERAGE MAXIMUM SNOWDEPTH



Wind

Winds in this region are channelled north and south along the Slocan Valley and blow from the southerly direction with only a slightly greater frequency than from a northerly direction. At low elevations, windspeeds over the year average 8.5 Km/h (2.3 M/s). Calm conditions prevail 33% of the time. Windspeeds increase with increasing elevation and wind direction is less influenced by valley orientation at the high elevations.

3.3.1 Climatic Capability for Agriculture

The capability of any particular unit of land to produce agricultural crops is dependent upon the combined influence of local climate and soils. The Climatic Capability Classification for Agriculture, however, considers only climatic influences. Actual agricultural capabilities are determined from either the climatic capability or soil capability classes, whichever is the most limiting.

The Climatic Capability Classification for Agriculture makes use of temperature and precipitation data, which typify a twenty to thirty year period, to indicate the range of crops which are climatically suited to any particular unit of land. Classes range from 1, where a very wide range of crops can be grown, to 7 where there is no potential for agriculture. Class 1 is further divided into super-classes ranging from 1a, where hardy apples and the more hardy heat loving vegetables can be grown, to class 1d where the less hardy tree fruits and heat loving vegetables can be grown. It is important to realize that the weather during any particular growing season may raise or lower the agricultural capabilities relative to those defined as the long-term condition.

The greatest climatic capability for agriculture in the study area occurs along the well drained lower slopes of the Slocan and Little Slocan river valleys where irrigation is available. Below these locations in the valley bottom, capabilities drop to class 2, and in some areas to class 3,

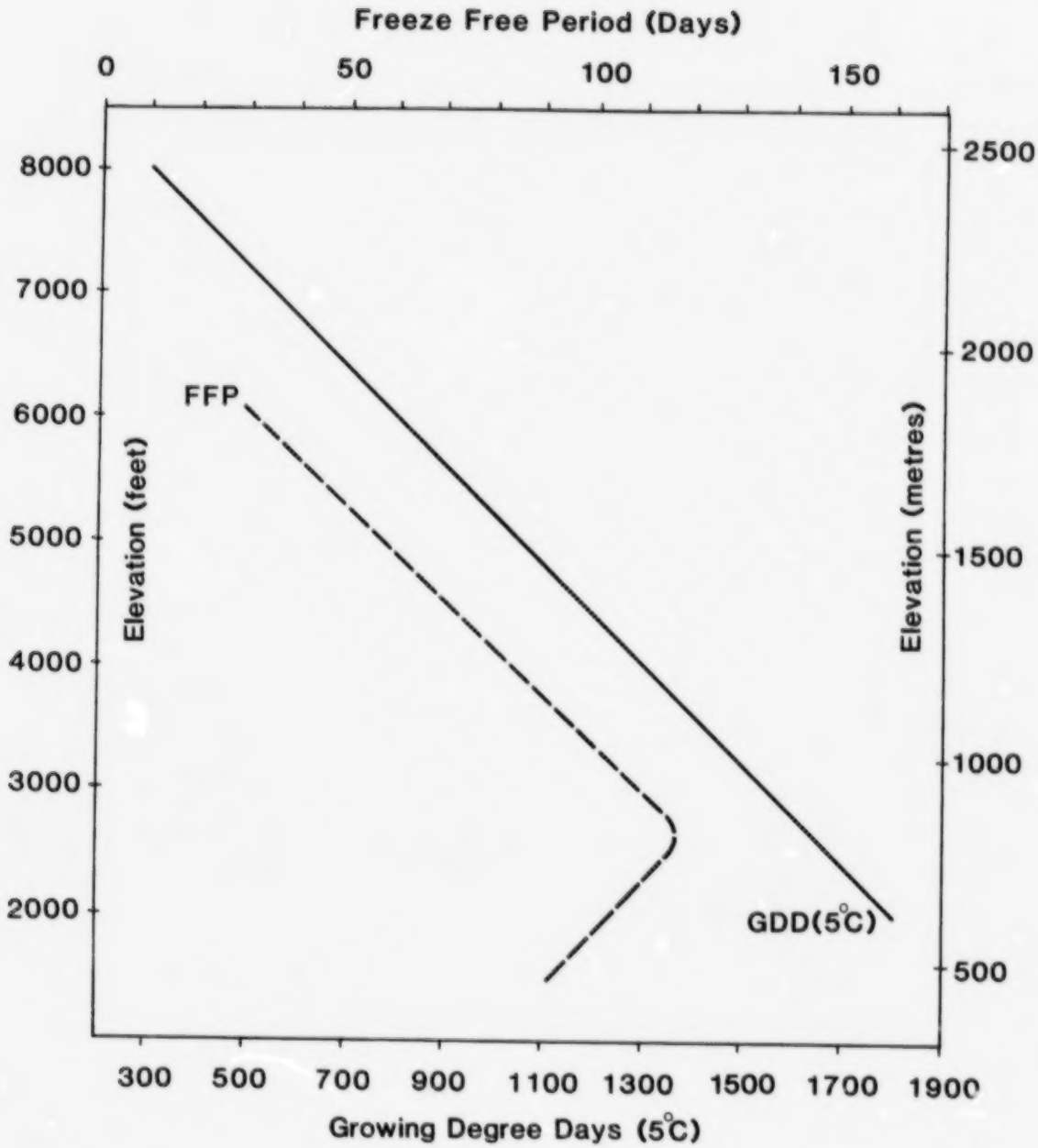


FIGURE 20: GENERALIZED RELATIONSHIP OF FREEZE FREE PERIOD (FFP) AND GROWING DEGREE DAYS (GDD) WITH ELEVATION

due to pooling of cold air which reduces the period free of freezing temperatures during the growing season. Above 3000' (915 m) capability classes decrease from 1a with increasing elevation due to decreasing temperatures which reduces the amount of heat available for plant growth, and due to decreasing freeze free periods (See Figure 20). Class 7 first appears around 6800' (2075 m).

Capabilities are reduced along the tributary valleys to the Slocan and Little Slocan rivers. These features tend to collect cold air from the higher elevations and funnel it to the lower elevations. Where this air flows into the major river valleys the land is more subject to freezing temperatures and agricultural capabilities are reduced accordingly.

Where irrigation is not available the Climatic Capability for Agriculture is determined from both thermal and moisture criteria. When the seasonal potential evapotranspiration exceeds the seasonal precipitation a climatic moisture deficit occurs and agricultural capabilities become reduced due to aridity. Under non-irrigated conditions capability classes range from class 5 near Crescent Valley to class 3 at Summit Lake and, because precipitation increases and temperature decreases with increasing elevation, dryland capabilities increase with elevation to 3000-4000' (915-1220 m) where aridity ceases to be a limitation.

The Climatic Capability for Agriculture ratings for the study area suggest that hardy tree fruits may be grown along the well drained lower slopes of the Slocan and Little Slocan river valleys. This may be so but it must be cautioned that extreme winter temperatures may, in the long-run, jeopardize the economic viability of such operations. To maximize the potential for the production of tree fruits, orchards should be located on low, well drained slopes of the Slocan and Little Slocan river valleys in areas sheltered from downslope cold air drainage and from exposure to winter winds. Sites close to Slocan Lake will have moderated winter temperatures which will minimize the physical damage suffered by fruit trees during outbreaks of very cold air.

Summary

Climate, or the long-term manifestation of weather, is not something which is simply imposed on the landscape as an atmospheric overlord of terrestrial serfs. In fact there is a close symbiotic relationship between climate, the earth's surface, and living organisms. A perpetual flux of heat energy and moisture occurs between the earth's physical and living surfaces and the overlying atmosphere; a change in character of one will, to some degree, affect the other. A change in climate can modify soil development processes and render areas more or less habitable for particular living organisms. Changes in soil surface characteristics or in vegetation type and distribution will in turn alter the local climate. Local climates collectively influence the character of the regional climate.

Although climate is a fundamental component of all ecological systems, it is a complex of climatic, edaphic and biotic factors which act upon organisms and ecological communities to influence their form and determine their survival. This ever-changing complex leads to a wide diversity of organisms and ecological communities. Cold tolerant species of flora and fauna exist in areas where the weather and soils are too cool for the more temperature sensitive species; heat tolerant species in areas too warm for others. Similarly all species exhibit a preference and tolerance for lesser or greater degrees of wetness and dryness.

The complex of thermal and moisture gradients over the study area have created a myriad of local climates which range from warm to cold and wet to dry. Such local climates determine the maximum amount of energy available for the growth of plants and define the net atmospheric contribution to the moisture regime of individual sites. However, in order to quantify the actual moisture stress to which surface vegetation is subjected, it is also necessary to know the water holding capacity of the soils particular to a site as well as the degree of soil moisture recharge in the spring.

Climatically induced moisture stress and stress from excessive temperatures decrease over the study area from southwest to northeast, with

increasing elevation, with a change of aspect away from southwest, and with a change of slope away from the optimum for the interception of solar radiation. At some point along these gradients temperature, and then moisture, cease to provide stressful conditions for individual species of vegetation and optimal conditions prevail. Further along these gradients optimal conditions give way to less desirable ones as lower temperatures, shorter growing seasons, and higher amounts of moisture begin to dominate.

Actual moisture stresses are increased anywhere along these gradients where soils have a low water holding capacity, low recharge of soil moisture in the spring, or a high rate of surface runoff. Conversely, moisture deficiency stresses are decreased and stresses from excessive moisture increased where soils receive an inflow of surface or subsurface moisture, where soils have a high water holding capacity and/or where there is full springtime recharge of soil moisture.

In the study area climatically induced moisture stresses are greatest at low elevations in the Kootenay River valley, on the valley bottom and lower west facing slopes of the southern Slocan valley, and along the lower elevation south facing slopes of the Little Slocan River, Winlaw, Trozzo, Lemon, and Pedro creeks where these tributary valleys meet the Slocan River valley. Lesser degrees of moisture stress occur in similar topographic locations in the central and northern portions of the study area.

Moisture stresses, due to increased solar radiation loading, may prevail on steeply inclined southwest facing slopes even at the higher elevations. Such sites can deter the successful establishment of many species of vegetation due to high surface temperatures - which may be lethal to sensitive germinants - high growing season moisture stresses, and by mild, sunny conditions which can lead to wintertime desiccation of an established plant if soil moisture is either inadequate or unavailable due to a frozen root-zone soil. These conditions disappear with a change of aspect towards the cooler and shadier northeastern slopes.

High elevation sites throughout the region have cool temperatures, short growing seasons, and an excess of moisture. Commonly, cool air from high elevations is channelled downslope along topographic depressions and over well drained slopes to areas where moisture regimes are drier. This process creates conditions for even greater ecological complexity.

3.4 AQUATIC RESOURCES

3.4.1 Study Area

The Aquatic Studies Branch undertook an inventory of the aquatic resources of the Slocan valley in 1981. Only the area to the north of Slocan City was investigated. The information presented in the aquatics map (see Appendix 1) is a summary of that survey as well as data provided by the regional Fish and Wildlife Branch in Nelson. Figures 21 and 22 further summarize this aquatics map by broadly indicating sport-fish distribution and areas of critical fish habitat (See Reference Map 4, in preparation).

Detailed aquatic biophysical mapping at a scale of 1:50 000 is currently being completed and should be available by late summer, 1982. Survey reports on the larger lakes which were studied in 1981 should also be available by summer, 1982.

Fisheries information for the southern half of the Slocan valley is also presented in Figures 21 and 22. These data were provided by the Fish and Wildlife Branch and by several local residents. Finalization of this information should await confirmation by additional surveys.

Fish Species Present

Several species of sport fish inhabit the area including Burbot (*Lota lota*), Dolly varden (*Salvelinus malma*), Kokanee (*Oncorhynchus nerka*), Rocky Mountain whitefish (*Prosopium williamsoni*), Rainbow trout (*Salmo gairdneri*) and Yellowstone cutthroat

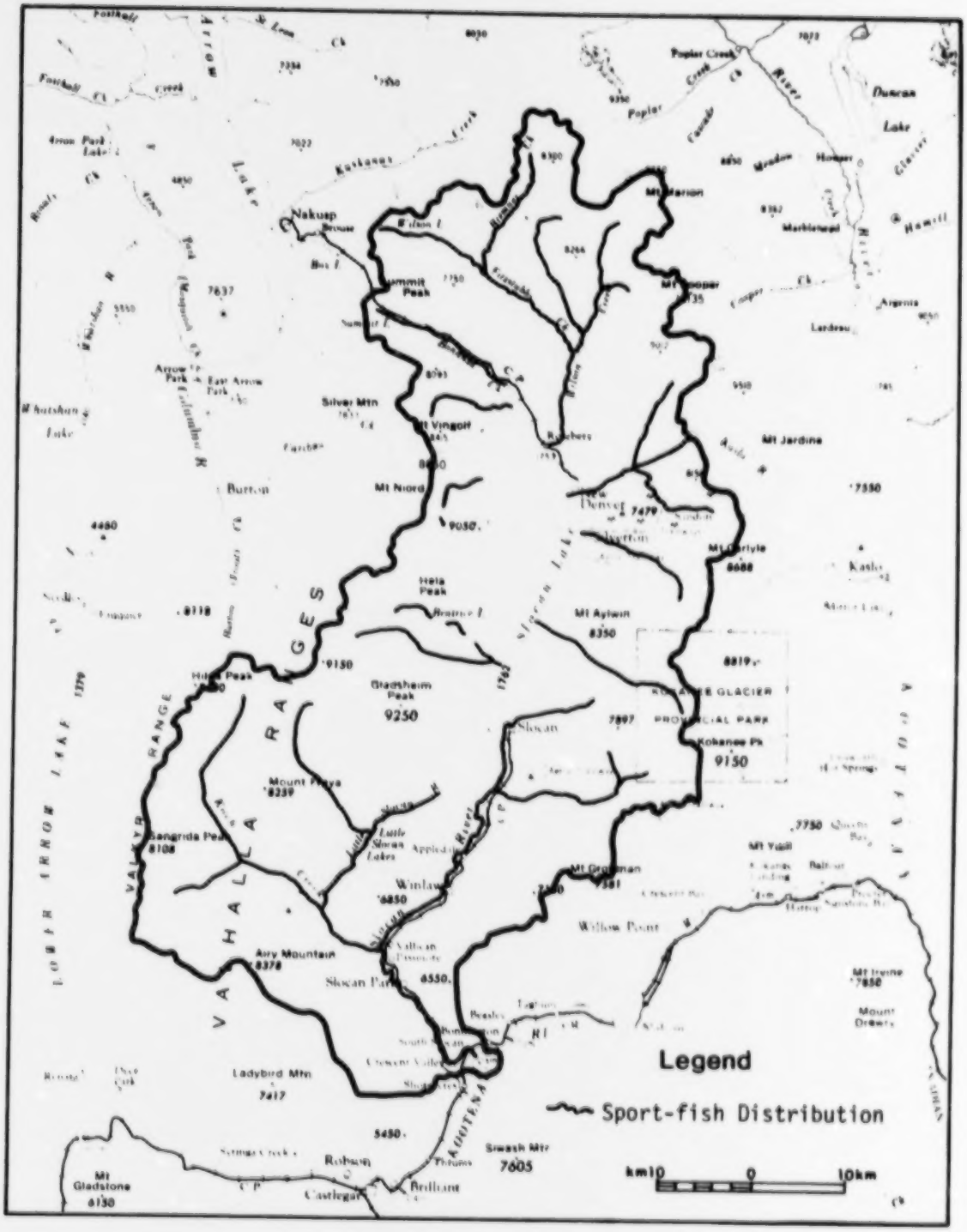


FIGURE 21: SPORT-FISH DISTRIBUTION

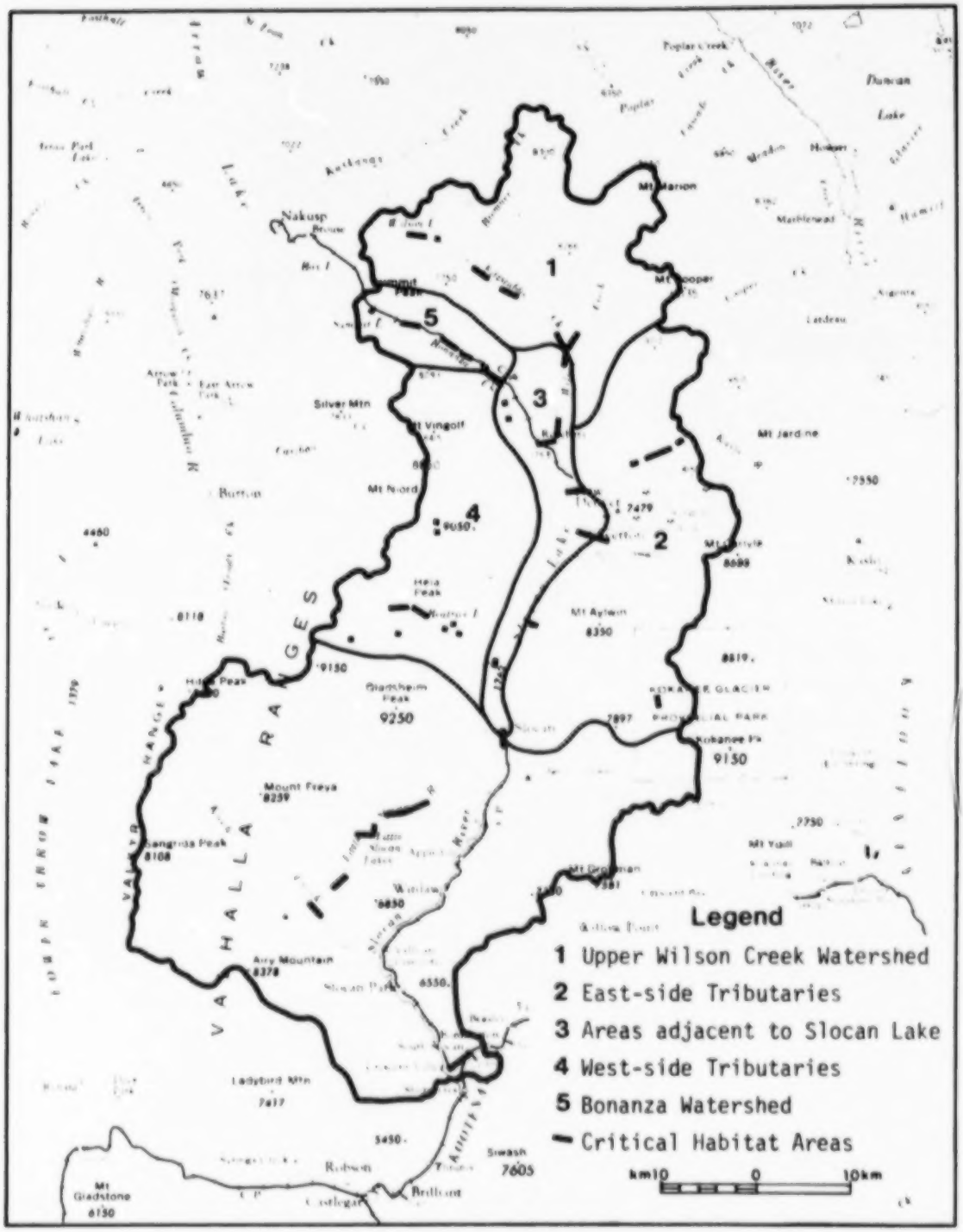


FIGURE 22: CRITICAL HABITAT AREAS

trout (*Salmo clarki lewisi*). Eastern brook trout (*Salvelinus fontinalis*) are present in various streams and lakes in the southern half of the Slocan valley.

Present also are coarse fish species such as lake chub (*Couesius plumbeus*), largescale sucker (*Catostomus macrocheilus*), Northern squawfish (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*) and sculpins (family Cottidae).

3.4.2 Fish Habitat (Sport-Fish) - General Requirements

To maintain the currently existing trout populations in the lakes of the area, suitable spawning and rearing conditions must exist nearby. In most cases these areas are located in the sections of inlet and outlet streams immediately adjacent to these lakes.

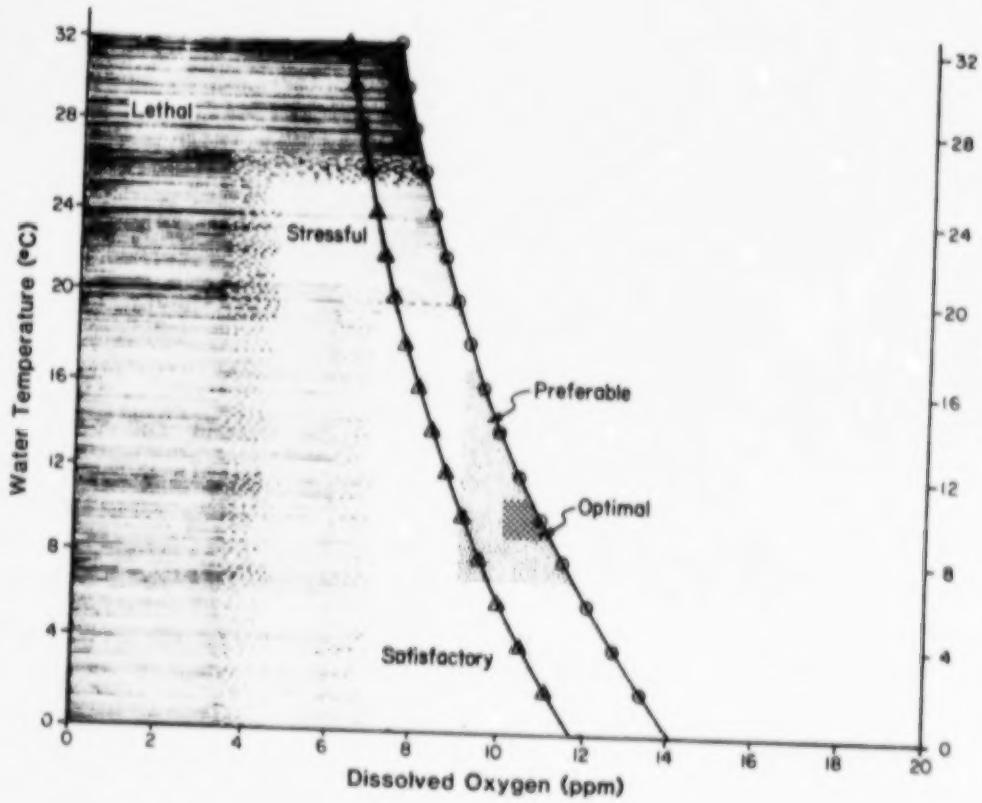
Spawning fish require streams where clean (sediment-free) gravel of size appropriate to the size of the spawning fish is present and where stable flows of clear, well-oxygenated water persist, especially while the eggs are incubating in the gravel. Ideal spawning water temperatures are in the 5°-13°C range with dissolved oxygen levels of at least 5 ppm. Substrate in the 0.5-10 cm range is generally utilized for spawning with the most optimum in the 1-6 cm size class. Obviously the larger the fish the larger the gravel that can be utilized for spawning purposes.

As well as sufficient oxygen levels and water temperatures, water velocity and permeability of the substrate are critical in successful incubation of the eggs in the gravel. Adequate velocity must be present to remove metabolic wastes and to bring dissolved oxygen to the eggs. Permeability relates to the amount of fine sands and silts present in the substrate which affects the ability of the water to remove waste material and replenish the oxygen supply. Excessive amounts of fine material can also hinder or even prevent the fry from emerging from the substrate.

Once the fry emerge from spawning gravels, escape cover, food, and sufficient water of moderate temperature become critical. These prime rearing areas are found in stream channels where banks are undercut providing shelter or where stable debris acts as the escape habitat, and overhanging vegetation affords a good food supply and protection from extremes of water temperature and predation. Fish food (invertebrates) production is highest in areas of large-sized (boulder-cobble) substrate and in riffle areas as opposed to pool habitat. Water temperatures of 20°-25°C are stressful to fish and temperatures of 26°-27° may become lethal.

Figure 23 illustrates the relationship between temperature and dissolved oxygen as it exists under natural conditions at sea level and at 1600 m (5250 ft.). Two trends are apparent from the figure: the concentration of dissolved oxygen in the water decreases as water temperature increases and/or elevation increases. Also indicated in Figure 23 are suggestions of habitat conditions preferred or avoided by rainbow trout. It can be seen that preferred locations (taking into account only water temperature and dissolved oxygen concentration) at or near sea level elevations exist in a rather narrow band where water temperatures are between 7°C and 17°C and oxygen concentrations are at least 9 parts per million. When fish habitat occurs at elevations of 1600 metres (5250 feet), as is found in high elevation areas in the valley, these preferred conditions are virtually nonexistent, thus the fish are required to make use of areas of more marginal suitability where growth rates may slow and reproductive capacity may decrease. Marginal fish habitat conditions will occur far more frequently in stagnant streams and very shallow lakes. This would indicate that any deleterious changes in water temperature or dissolved oxygen as might possibly occur as a result of land development practices may have a serious effect on the rainbow trout populations of the area. These effects would be less pronounced on populations existing at or near sea level since more flexibility (a much wider "preference band") exists.

A short summary of the role of suspended sediment in the stream channel environment is provided at the end of the Aquatic Resources section of this report.



⊗ Solubility of oxygen at sea level (adapted from Hutchinson, 1957)

▲ Solubility of oxygen at 1600 metres (5250 feet) (adapted from Hutchinson, 1957)

Note:
- Lethal conditions may be tolerated for short periods of time
- Fish acclimated to poorer conditions may survive lethal conditions for a longer period of time than non-acclimated individuals
- Rapid changes in oxygen or temperature over a short time period may also be lethal
- Gradations not exact, lines exist between zones

FIGURE 23: SUGGESTED HABITAT PREFERENCE BY RAINBOW TROUT

3.4.2.1 Fish Habitat - Upper Slocan Valley

Due to the very strong topographic influence, most of the streams in the area are characterized by steep gradients and streambeds of large-sized material. This precludes much spawning or rearing except in the small sections scattered throughout where more favourable habitat exists (gradient of only 1-2%, adequate stream cover, smaller substrate material, etc.). These areas are indicated on Figure 22. They have been termed "critical" due to their scarcity and to the sensitivity of the fishery resource to their degradation.

Stream sections of low gradient adjacent to Slocan and other large lakes in the area (e.g. Evans, Beatrice, Wilson and Little Wilson) are the most critical of these areas for fish populations and hence require the most protection when development is being considered.

Many of the tributaries to Slocan Lake have large falls or velocity barriers near their mouths preventing upstream migration from the lake. Notable exceptions to this are Bonanza, Wilson, Carpenter and Silverton Creeks.

Many of the lakes in this area have been stocked in the past (e.g. Wragge, Wee Sandy, Shannon, Evans, Beatrice, and Cahill) and, in several, natural reproduction is occurring while continued stocking appears necessary in others.

Water quality appeared good in most streams, except for some high suspended sediment levels, much of which appeared natural as a result of glaciers or terrain. The aquatic habitat of Carpenter Creek appears to have suffered from the mining activity which has occurred there over the past few decades.

Due to the topographic influence it appeared useful to divide the study area into several zones (see Figure 22) in order to be more specific in a discussion of the aquatic habitat and hence values:

1 Upper Wilson Creek Watershed - this zone contained several areas, especially mid- and upper-Fitzstubbs, the Wilson-Fitzstubbs confluence and around the mouths of tributaries such as Bremner, where habitat appeared suitable for spawning and/or rearing. These areas are characterized by relatively low gradient meandering channels with adequate cover provided by riparian vegetation and suitably-sized substrate (much of the bottom material under 10 cm in diameter). The remainder of this zone contained steeper gradient channels (5-10%) with much larger substrate (material 30-100 cm in diameter) or a cascading-type flow. Fish are believed to utilize only very small isolated sections (e.g. deep pools) under these conditions.

2 East-side Tributaries - fish potential was considered low in this area due mainly to the steep gradient in most streams. Only isolated pockets are believed utilized to any great extent by fish. Lakes at the upper ends of Enterprise and Silverton Creeks have been stocked in the past. Fish were found in abundance at one point at the upper end of Enterp ise Creek, no doubt due to the proximity of the point to one of the stocked lakes. The mid- and upper-sections of Fennell and upper Silverton Creeks contained areas of good habitat but fish distribution patterns in these areas could not be established.

3 Areas adjacent to Slocan Lake - this zone is very important to the continuation of the very good fishery which currently exists in Slocan Lake. Many of the extreme lower ends of the tributaries entering the lake contain areas suitable for spawning, and where this habitat exists protection is mandatory.

4 West-side Tributaries - the influence of topography is most noticeable in this zone. Much of the stream lengths here have minimal potential for fish use due to the very steep gradients. Fisheries values are much higher however in lakes such as Evans, Beatrice and

Cahill where a recreational fishery exists. Stream sections adjacent to these lakes and the foreshore areas are critical to the fish population present and should be afforded protection.

5 Bonanza Watershed - Bonanza Creek appeared to contain the best and greatest amount of rearing and spawning areas in the north half of the Slocan Valley. As such it warrants the greatest degree of protection. The most critical areas appear to be the delta at Slocan Lake, the meandering sections located throughout the creek and the stream section between Summit Lake to below the highway crossing.

In summary, due to the steep terrain, a large percentage of the aquatic habitat would be rated minimal for fisheries. Where the terrain is flat, and in the stream sections adjacent to the larger lakes in the area, much higher fisheries values exist. These areas above all others should be termed critical and receive all possible protection.

3.4.2.2 Fish Habitat - Lower Slocan Valley

As has been stated previously the 1981 inventory did not extend south of Slocan City but information on the aquatic resources for the south half of the valley was obtained from local residents and the Regional Fish and Wildlife Branch in Nelson. This information has been included on the map but may be subject to refinement if further inventory and analysis of the aquatic resource occurs.

Sport-fish appear to be distributed throughout the mainstem Slocan and Little Slocan Rivers as well as the larger tributaries to both. It has been reported that the lower ends of many of the small tributaries to the mainstem Slocan River are used as "nursery creeks" for juvenile rearing, an additional use which should be considered in water allocations.

3.4.3 Suspended Sediment in the Stream Channel Environment

Methods of Entrance

- vegetative cover is of primary importance in reducing surface erosion; it reduces the possibility of overland flow by depleting soil moisture through evapotranspiration, dissipates raindrop energy, improves soil strcture, and offers a continuous root mat to help bind soil together.
- in undisturbed forest conditions water generally moves (1) overland in established drainage channels and (2) subsurface via seepage routes; little suspended sediment is normally generated from undisturbed forests.
- increases in total water yield generally occur after a watershed has been logged: this is mainly due to (1) reduced evapotranspiration and (2) increased overland flow due to the compaction of the soil during road-building and logging and (3) the redistribution of snow by forest harvesting openings. Streamflow peaks may also be increased due to interception of subsurface flow by road cuts and ditches.
- size of peak flows may or may not be increased following logging; significant increases in peak flows are generally not expected unless roughly 12% or more of total area is compacted by roads, tractors etc., or over 25% of the basin is harvested. An increase can be expected in the average peak flows in the fall but not so much in winter, and the large peaks are generally not affected by logging although summer low flows do increase.
- in low gradient streams bank failure caused by lateral stream erosion probably delivers most of the finer material.
- in steep terrain most sediment enters via avalanches, soil mass movements and increased bank instability from encroachment of slumps and slides into the channel.
- grazing tends to increase run-off and erosion by reducing plant cover density and by compacting or detaching surface soils.

Effects on Stream

- reduces potability and increases water treatment costs
- aesthetically objectionable/unattractive
- reduces recreation potential
- harms fishery resource
  - suspended sediment input to lakes reduces light penetration thereby lowering productivity and fish growth.
  - invertebrate biomass is closely related to suspended sediment loading probably because the deposited sediment clogs the gravel interstices reducing the living space for the invertebrates.
  - rubble areas in riffles, runs, and pools provide summer and especially over-winter habitat for trout and salmon - these areas can be easily filled in by sediment.
  - high sediment loadings in May to July may cause substantial subgravel deposition even though surface gravels are swept clean. This condition causes low egg survival especially if oxygen levels fall below 4 mg/l in the gravel.

Land Management Activities: Suggestions

- attempt to log at low or normal periods of flow; avoid periods of high soil water content.
- reduce harvesting rate or use extra protective measures in high elevation areas subject to sudden snowmelt.
- avoid logging close to lake outlet streams.
- as there exists an inverse relationship between the rate of erosion and the percentage of roots in stream banks, buffer strips are exceedingly important in most areas.
- in disturbed areas - use: contoured skid-trail design, water-bars and cross-ditches on skid and secondary roads, and revegetate landings, skid-trails, and cut and fill slopes.

Summary: Suspended Sediment

The effects of increased suspended sediment loading on stream habitat may not be as readily observable as those caused by excessive debris but are just as important and are almost exclusively adverse.

3.5 VISUAL RESOURCE EVALUATION

> "Visual characteristics of the landscapes and their relationships are the raw material from which landscape resources inventories may be developed" (Litton, 1979).

In order to obtain a better understanding of relationships, visual or otherwise, it is important to obtain a grasp of the regional context within which those relationships take place. The Slocan Valley and its environs is characteristically "form dominant", expressing extremes in topography throughout its length. A highly variable climatic pattern and diversity of vegetation adds to the area's visual significance.

The Slocan Valley is central to Holland's "Interior System" which includes the Northern and Southern Plateaus and Mountains, the Central Plateau and Mountain Area (within which the Slocan occurs) and the Rocky Mountain Trench. This classification has been simplified for this paper into the Columbia Mountains and Southern Rockies Physiographic Region.

The Columbia Mountains consist of parallel ranges - the Purcell, Selkirk, Monashee and Cariboo Mountains - which form a triangular wedge between the Rocky Mountain Trench and the Fraser Plateau. The Slocan Valley lies in the south central portion of the Columbia Mountains and is surrounded in its central portion by dramatic peaks, glaciers and snowfields of the Purcell Range to the west (Valhallas) and to the east (Kokanee Glacier Park).

Slocan Lake is the area's dominant water feature; the Valhallas are the most apparent and dominant landforms while the Slocan and Little Slocan

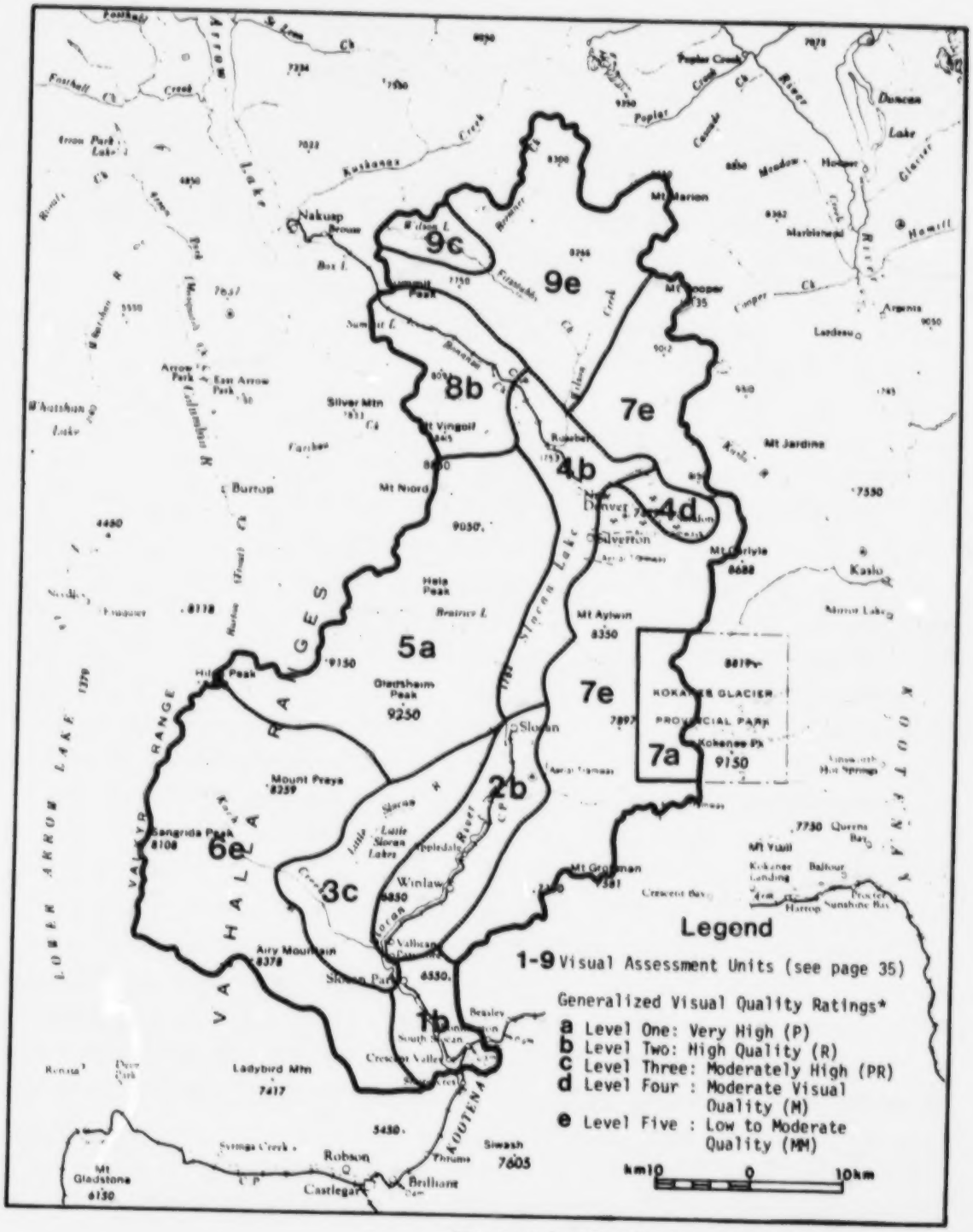
Rivers add to the valley's visual interest in their flow southward to the Kootenay River. Thus, the Slocan, in its entirety, is an area rich in visual interest and variety, divided essentially into two main sectors, or settings: (1) the northern setting including Summit and Slocan Lakes and (2) the southern sector which is composed mainly of valley and ridge settings reaching from the community of Slocan down the Slocan and Little Slocan Rivers to the project area's south boundary at Crescent Valley.

For purposes of conducting a visual analysis, the Slocan Valley was subdivided into nine Visual Assessment Units, or composite viewsheds, each with its own set of visual characteristics. These follow, as shown on Figure 24. (For more detailed example see Reference Map 6).

Visual Assessment Unit	
1	Lower Slocan Valley
2	Slocan Valley - West Perry Ridge
3	Little Slocan Valley - East Perry Ridge
4	Slocan Village to Hills Scenic Corridor
5	Valhalla Ranges including west shoreline of Slocan Lake
6	West Slocan Valley Drainage
7	East Slocan Valley Drainage
8	Hills to Summit Lake Scenic Corridor
9	Wilson Creek Drainage

Criteria for designation included height of land, drainage systems, transporation routes, major water bodies and rivers, outstanding or unusual vegetation and/or landforms, relatively uniform landscapes and, lastly areas of human settlement.

Each of the Assessment Units was evaluated for such factors as visual variety, significant features, viewing characteristics (how seen), sensitivity to development (as it would affect visual continuity), constraints, or deviations from its natural values in terms of form, line, colour and



*See text for clarification of symbols P,R,PR,M,MM.

FIGURE 24: GENERALIZED VISUAL QUALITY RATINGS

texture, landform and landcover characteristics and the ability of the landscape to be modified with least visual impact (visual absorption capability).

In view of limitations imposed by the mapping scale involved in this study, field observations were reconnaissance in nature. However, in general the most visually sensitive areas in the Slocan Valley are lakes, lakeshores, rivers and stream environments; foreground viewing along main travel routes and middleground views of ridges flanking all travel routes (see Reference Map 5). Background panoramae are particularly striking in the Valhallas as seen westward from Route #6 and Frog Peak in the Norn's Range as viewed southward from Route #6 and the Little Slocan mainline road. Frog Peak has been painted by a number of local artists much in the nature of a "motif" for the valley.

Visual quality ratings, based on assessment factors outlined above, were divided into five levels, ranging from "Very High" to "Low to Moderate". They are not intended as site specific indicators. A much more detailed ground/air analysis will be required to identify specific sight lines, viewshed boundaries and feature identification. However, in a regional context, the ratings do indicate relative values and should clearly identify generalized area of landscape sensitivity when management objectives within the study area are more clearly identified (see Reference Map 7).

Although visual quality ratings do relate to observer access and observer position, they do not and cannot reflect numerical values. In other words, visual value assessments relate more to essential visual qualities inherent in the experience of seeing rather than necessarily involving quantitative measurements of the numbers of viewers involved - although the latter is an important factor. Thus the Valhalla Ranges and Slocan Lake Units rate "very high" in all assessment factors (visual variety, sensitivity, features, etc.) even though viewed internally by a relatively few number of people.

The following general guidelines indicate vulnerability characteristics of each Assessment Unit's Visual Quality Rating (VQR):

Quality Level	Visual Characteristics
Level One	Low foreground, middleground and background visual absorption capability (VAC)
Level Two	Low fg, mg and moderate bg VAC
Level Three	Low fg, moderate mg and moderate bg VAC
Level Four	Moderate fg, moderate mg and high bg VAC
Level Five	Moderate fg but high mg and high bg VAC

It should be emphasized that within each of the above ratings, some variations occur. In other words not all of the Level Five areas are low in quality. For example, creeks and valley viewsheds in Assessment Units 6 and 7, such as Koch and Haden Creeks (Unit 6) and Perry, Lemon and Springer Creeks (Unit 7) as well as the upper Wilson Creek drainage (Wilson Lake) in Unit 9 would be rated higher in visual quality due to the presence of water and riparian vegetation: thus more sensitive to visual impact. Likewise, the most northerly portion of Unit 5 (Valhallas) beyond Wee Sandy Creek would rank lower than the Beatrice and Nemo Creek watersheds in view of its proximity to logging activity readily observable up Shannon Creek.

In summary, the Slocan Valley Project Area, from Crescent Valley north to its terminus at Summit Lake has an interesting and diverse sequence of visual events. With a few exceptions, the area still reflects a relatively undisturbed series of pastoral, enclosed and panoramic visual experiences but its best use will call for awareness of its sensitivity to encroachment - particularly the forest environment. Visual resource management will be required throughout the valley if its present natural qualities are to be maintained.

For recommended management purposes Quality Levels can be translated to visual quality objectives (VQO) as follows:

Level One(A): Preservation (P), where the scenic and ecological integrity of the area is retained in its natural state.

Level Two(B): Retention (R), where a management activity may prevail, but must not alter the essential form, line, colour and texture of the characteristic landscape.

Level Three(C): Partial Retention (PR), where a management activity may change the essential form, line, colour and texture of the characteristic landscape but must remain subordinate to its visual strength.

Level Four(D): Modification (M), where management activities may subordinate the characteristic landscape, but where introduced dominance factors not found in the natural character type must remain subordinate to its proposed natural appearance.

Level Five(E): Maximum Modification (MM), where management activities may subordinate the original characteristic landscape and may not borrow from naturally established dominance factors except when viewed as background.

4.0 APPLICATION OF THE INFORMATION IN THIS REPORT

Every user, ultimately makes value judgments, as objectives are pursued. The user is the subject, the physical resource is the object. The quality (i.e. value) of a resource is defined by the experience of the subject and object:

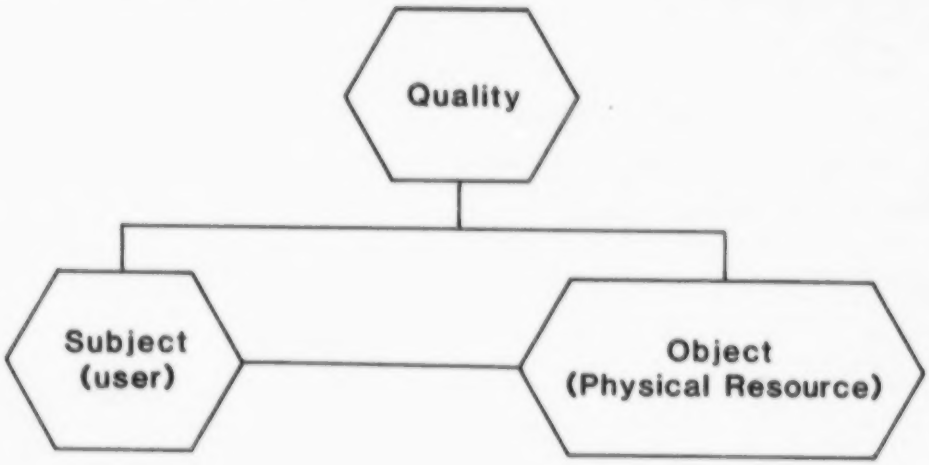


FIGURE 25: THREE WAY RELATIONSHIP QUALITY TO THE RESOURCE USER AND THE PHYSICAL RESOURCE

High quality resource values occur where the most favourable experiences exist between user and the resource base. There is a very high correlation between soil associations and resource values. Examples are give in Table 6.

Management of the resource requires subsequent interpretations based on a knowledge of the opportunities and limitations which exist physically, biologically and those based on economics and social criteria. Commonly this is (intuitively) achieved by a benefit/or cost versus risks evaluation. In other words, is the proposal worthwhile? Are the risks acceptable?

By knowing the quality of the land, a judgment on benefits and costs can be made. By knowing the natural hazards which exist, a judgment on risks is possible.

Efforts to improve precision in measuring benefits and risks are provided by indices of various kinds. Some examples from this report are: Forest capability ratings, climate capability ratings, climatic moisture balance, visual absorption capacity, and land capability for outdoor recreation.

All are indices of the quality (and quantity) and various resource values. Each will help the user define what can be done (potential) leading to what should be done.

In the context of evaluating the land for the most appropriate land use it is important to integrate the information from all disciplines, including the physical resources (soil, climate, etc.), technological resources (engineering, etc.) and value relationships (economics, etc.).

The integration of concepts and related information can help establish where the opportunities and limitations occur, in space or well as time, and reliable inferences can be made as to what kind of use is best suited to what kind of land. Ultimately of course, value judgements must be made where priority uses must be chosen. The degree to which integration can be achieved will depend largely on the flexibility which exists in the resource potential of the land. The ultimate choice, of course, is a social decision and determined by needs and values of the land users.

TABLE 5
RELATIONSHIP BETWEEN RESOURCE VALUES AND SOIL ASSOCIATIONS (EXAMPLES)

RESOURCE VALUE	SOIL ASSOCIATION	SOIL PARENT MATERIAL	FOREST ZONE
Agriculture Land	Avis (AS)	Medium to moderately coarse textured	Interior western hemlock - western red cedar
	Lawley (LY)	Moderately fine textured lacustrine deposits	Interior western hemlock - western red cedar
Caribou Habitat	Beatrice (BC)	Shallow, moderately coarse to coarse texture colluvium overlying coarse grained acidic bedrock	Subalpine Engelmann spruce - alpine fir
	Brouse (BE)	Shallow, medium textured colluvium, overlying fine grained bedrock	Krummholz Subalpine Engelmann spruce - alpine fir
	Bluejoint (BT)	Shallow, moderately coarse textured colluvium overlying coarse grained bedrock	Krummholz Subalpine Engelmann spruce - alpine fir
Deer Winter Range	Kinert (KR)	Loose, well to poorly sorted glaciofluvial ice-contact deposits	Rocky Mountain Douglas-fir
	Kaslo (KO)	Loose, well to poorly sorted, moderately coarse textured glaciofluvial ice-contact deposits	Interior western hemlock - western red cedar
Forest Land	Slocan (SN)	Moderately coarse textured basal till	Interior western hemlock - western red cedar
	Cataract (CE)	Deep, medium to moderately coarse grained colluvium	Interior western hemlock - western red cedar
	Calamity (CL)	Deep, medium textured colluvium	Interior western hemlock - western red cedar

TABLE 5 (Continued)

RESOURCE VALUE	SOIL ASSOCIATION	SOIL PARENT MATERIAL	FOREST ZONE
Forest Land (Continued)	Kaslo (KO)	Loose, well to poorly sorted, moderately coarse textured glacio-fluvial ice-contact deposits	Interior western hemlock - western red cedar
Visual	Bohan Creek (BK)	Shallow, medium to moderately textured colluvium, overlying medium-grained bedrock	Interior western hemlock - western red cedar
	Buhl Creek (BH)	Shallow, moderately coarse textured colluvium overlying coarse grained acidic bedrock	Interior western hemlock - western red cedar
	Cataract (CE)	Deep, medium to moderately coarse grained colluvium	Interior western hemlock - western red cedar
	Calamity (CL)	Deep, medium textured colluvium	Interior western hemlock - western red cedar
	Slocan (SN)	Moderately coarse textured basal till	Interior western hemlock - western red cedar

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6.0 GLOSSARY OF TERMS

CLIMATIC CLIMAX - A climax community developed on an average (model) site (usually: medium-textured, well-drained, not on south facing slopes, deep soils lacking extraordinary soil chemical proportion). It is often suggested that these climatic climax communities best characterize the bioclimate of an area.

CLIMATIC MOISTURE BALANCE (CMB) - The net arithmetic difference between potential evapotranspiration and precipitation during a specific period of time. This identifies the potential degree and direction of the atmospherically induced net moisture flux across the atmosphere-earth interface.

CLIMATIC MOISTURE DEFICIT (CMD) - A negative Climatic Moisture Balance. The amount of moisture which, if available, would be evaporated from a given land area in excess of that precipitated on the same area over the same period of time.

CLIMATIC MOISTURE SURPLUS (CMS) - A positive Climatic Moisture Balance. The amount of moisture falling on a given land area in excess of that potentially evaporated from the same area over the same period of time.

CLIMAX - Plant communities of a site develop through a series of stages to a final self, regenerating community. Such communities are referred to as climax. The species composition of a climax community is determined by local climate, soil, topography, the biotic area and recent geological age. Fires, cutting and other external influences may alter the vegetation, so that again through a series of stages it develops towards the same climax community.

DISCLIMAX - A self perpetuating community that has developed after repeated disturbances that altered the site, and which differs from the usual climax community. High competition for space and moisture in thick grass swards may prevent the establishment of the usual forest vegetation. Salt accumulations in areas directly exposed to sun heat may prove toxic to Rocky Mountain Douglas-fir or ponderosa pine.

DISTANCE ZONES (DZ) - Involves <u>foreground</u> (fg), 0 to 1/2 - 1 km, which reveals form line, colour and texture; <u>middleground</u> (mg), from 1/2 - 1 km to 5 - 8 km, where texture usually diminishes in value and <u>background</u> (bg), 5 -8 km to infinity, where form and line predominate.

EDAPHIC - Due to extraordinary factors in the soil (usually topographic factors are included). The term is often used in conjunction with a climax community to indicate the reason why the community differs from the predominant climax of average sites. Wet soils, lime-rich soils, shallow droughty soils are some of the edaphic reasons, producing unusual vegetation communities.

FREEZE FREE PERIOD (FFP) - The interval, in days, between the last and first occurrences of 0°C temperatures in spring and fall.

GROWING DEGREE DAY (GDD) - A measure of the departure of the mean daily temperature above a specific threshold temperature; 5°C fr GDD_c, 42°F for GDD_f. A single degree day represents a departure of one degree above the threshold. Daily values are summed to provide degree day totals for any particular period of time or season.

OBSERVER POSITION (OP) - Observer above, observer below and observer normal refer to the specific position of the viewer related to the object or landscape viewed. Generally, the "observer above" position decreases the VAC while the "observer below" and "observer normal" positions increase it.

POTENTIAL EVAPOTRANSPIRATION (PET) - The amount of moisture which, if available, would be removed from a given area of land by the combined effects of evaporation from the soil and transpiration by surface vegetation.

REGION - See Vegetation Region.

SEASONAL - As used in this report, is an adjective which refers to the period extending from May 1st to September 30th.

SECTION - See Vegetation Section.

SENSITIVITY LEVELS - These are a measure of people's concern for the scenic quality of an area as seen from roads, trails, recreation sites and visitor centres. Three sensitivity levels are employed: level 1 - highest sensitivity, level 2 - averages sensitivity, level 3 - lowest sensitivity. Sensitivity levels are more site specific than "Primary Sensitivity Zones" (see Appendix) which generalize the combined values or levels of sensitivity at a broader level of mapping.

SERAL, SERE - Each stage in the succession towards the climax is a sere. Species belonging to these stages other than the climax community are seral species, each stage other than the climax stage is a seral community.

SUBZONES - See Vegetation Subzones.

SUCCESSION - The sequential replacement of plant communities until a stable state (climax) community has formed. Succession is driven by one or more of the following processes: 1) chance establishment of seeds or roots, etc.; 2) site preparation through modification of soil and seed bed and microclimate; 3) competition between plants for space, moisture and nutrients.

VARIETY CLASSES - These are obtained by classifying the landscape into three degrees of variety: class A - distinctive, class B - common, class C - minimal. Features affecting the classification are: landform, rockform, waterform (lakes and streams), and vegetation.

VEGETATION REGION - A geographic area for which the vertical vegetation patterns have common characteristics resulting from the macroclimactic conditions that prevail throughout. Macroclimate refers to the variations in climate that result from the high level flows of airmasses.

VEGETATION (FOREST) SECTION - A subdivision of a Vegetation Region, a geographic area for which a characteristic vertical vegetation pattern exists which reflects the specific conditions of the macroclimate (overhead airmass).

VEGETATION (FOREST) SUBZONE - A subdivision of a vegetation zone, the subzone is an area in which similar sites can support the same seral vegetation reflecting similar mesoclimatic conditions and a consistent process of microclimate development in the plant community. Mesoclimate refers to the specific condition of the atmosphere immediately above the site. It is described directly by the usual climatic parameters of temperature, precipitation, etc. Mesoclimate is directly experienced by dominant vegetation and man.

VEGETATION (FOREST) ZONE - An area over which similar sites can produce the same dominant climax vegetation as the whale zone is influenced by the same mesoclimatic conditions.

VEGETATION ZONATION - The pattern of Regions, Sections, Zones and Subzones of any geographic area. Also used to refer to the classification scheme itself.

VISUAL ABSORPTION CAPABILITY (VAC) - This is the ability of the landscape to absorb management activities or development with minimal affect on its inherent visual quality. VAC is determined primarily on the basis of slope, vegetative cover nd regeneration, landscape diversity and soil and rock colour contrast (as exposed by landscape alterations).

VISUAL QUALITY (VQ) - This refers to varying levels of quality in the landscape as expressed by a combination of variety, contrast, interest and attraction as experienced by the observer.

APPENDIX I
MAP REFERENCES

The following maps were prepared and/or derived (at the 1:125 000 scale) for the Slocan Valley Planning Program.

1. Soils: A description of soil associations.
2. Soil Factors Affecting Mass Movement: An interpretation of the soils maps defining soil stability.
3. Soil Limitations for Residential Settlement: An interpretation of the soil map defining the limitations for residential use.
4. Aquatic Resources of the Slocan
   This map illustrates two different aspects of the aquatic resources of the Slocan valley:
   a. sport-fish distribution - (1) as a result of 1981 Aquatic Studies Branch inventory program, and (2) resulting from information supplied by the Fish and Wildlife Branch in Nelson and by several local residents.
   b. critical habitat areas - (1) and (2) as above. These areas were deemed critical to the survival of the fish populations in the vicinity.

   Also illustrated are the point locations where sampling actually occurred and the watershed coding (numbering) system used by the Provincial government.
5. Visual Attraction Features as reported by Valley Residents.
6. Visual Assessment Units: A more detailed version than Figure 24 in this report.
7. Visual Assessment Analysis: Combines "Visual Absorption Capability Ratings" and "Generalized Sensitivity Zones" to show key relationship involved.

Other maps which are available are (at various scales):

1. Soil Capability for Agriculture
2. Land Capability for Forestry

3. Aquatic Biophysical (in preparation, available late 1982)
4. Climate Capability for Agriculture
5. Land Capability for Wildlife - Ungulates
6. Land Capability for Wildlife - Waterfowl
7. Land Capability for Recreation
8. Vegetation Zonation

Paper prints of individual maps are available from the following locations:

1. Regional District of Central Kootenay,
   601 Vernon Street,
   Nelson, B.C.
   V1L 1E9

2. Ministry of Environment,
   Assessment and Planning Division,
   Map Library,
   765 Broughton Street,
   Victoria, B.C.
   V8V 1X5

APPENDIX II
GENERALIZED LAND CAPABILITY FOR OUTDOOR RECREATION

The following is taken directly from the Canada Land Inventory 1:50 000 map legend (1968):

"Tributary to the Kootenay River is the picturesque Slocan River Valley. Small farm communities in a pastoral setting are the main attraction, and there are good opportunities for fishing and camping along the Slocan River. Slocan Lake has only moderate capability for intensive recreation and low capability for sport fishing.* However, it is a very scenic area, where steep slopes rise continuously for several thousand feet from the water's edge. The west shore offers frequent sand beaches and access to the dramatic alpine country to the west.

"The Evans-Beatrice-Cahill Lakes area forms another dramatic upland. The lakes lie west of Slocan Lake at elevations of 4000 to 5000 feet. Mountain scenery, subalpine forest, and fishing are the main attractions, and Gladsheim and Gimli peaks at the head of Mulvey Creek provide an important focus for rock climbing.

"Mining has always played an important role in the region and many abandoned mines, the ghost town of Sandon, and old structures at Kaslo, New Denver, Silverton, Slocan, Nelson, Trail, and Rossland are significant historic attractions."

*Note: Terms of reference for the CLI reconnaissance mapping for outdoor recreation defined seven classes of land differentiated on the basis of the "intensity of recreation use which may be generated and sustained per unit area of land ... under perfect marketing conditions." Thus, extended area recreation opportunities, where a limited number of users might be involved, were not evaluated beyond Class Four - "moderate". This factor is to be emphasized when the CLI information is applied to the Slocan valley, where hiking, riding, boating and driving for pleasure may be enjoyed in an outstanding scenic setting - but not necessarily in quantitative terms.

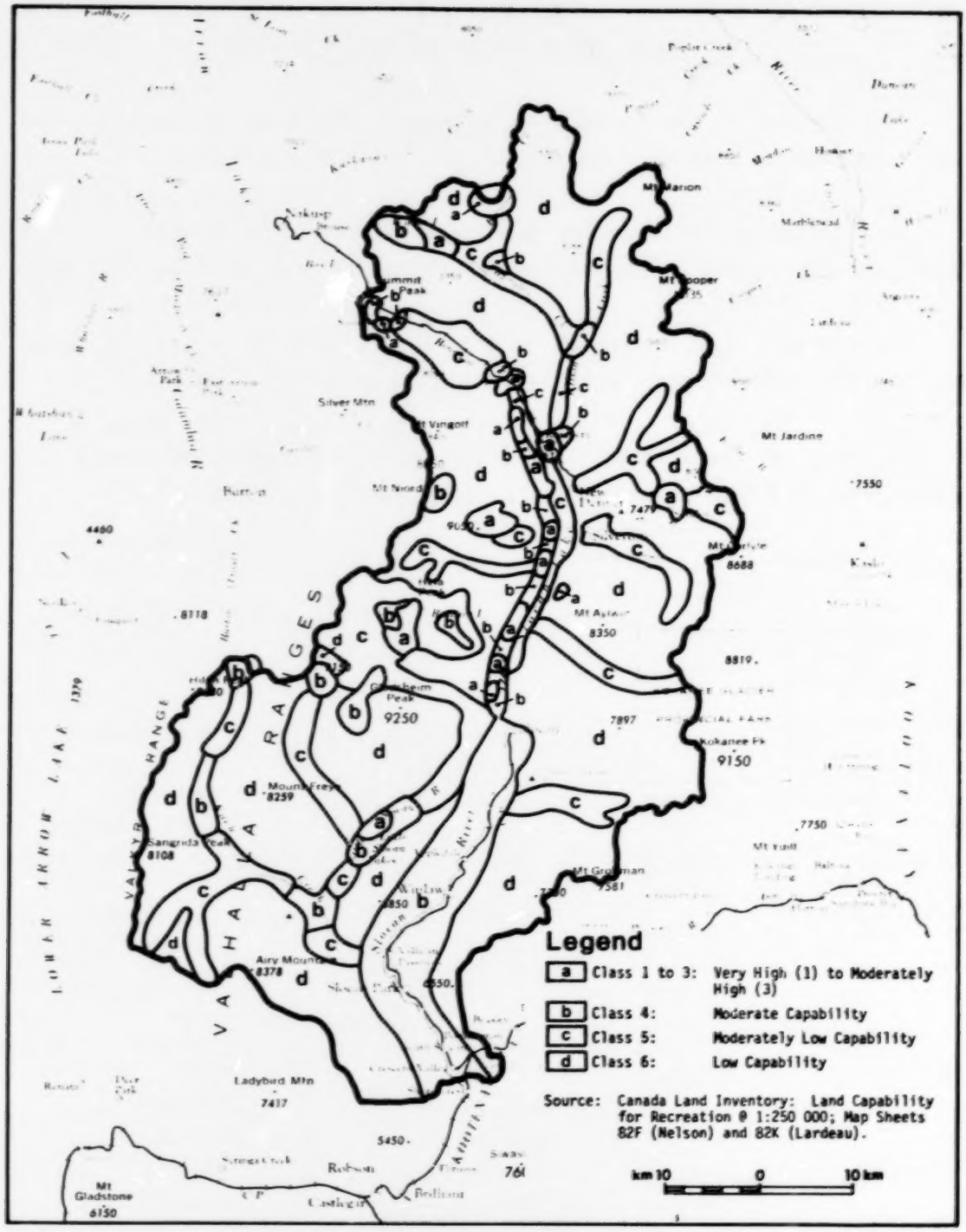

FIGURE 26: GENERALIZED LAND CAPABILITY FOR RECREATION

APPENDIX III
SOIL VEGETATION RELATIONSHIPS

The purpose of the Appendix is to enable the reader to correlate the soil associations with the vegetation types in the Slocan Valley.

The following three tables make these correlations directly for the north end (82F/NW and 82F/SW) of the valley, but not the south end (82K/SW).

In the Vegetation Chapter of this report it is explained to the reader how similar relationships can be made for similar soils in 82K/SW.

A study of these relationships will help the reader understand the relationshiips between climate, soil, vegetation, and relief.

TABLE 1
SOIL ASSOCIATION DESCRIPTIONS

Soil Assn. Name (Map Symbol)	Soil Assn. Component	Dominant Soil Subgroup	Drainage (see box B)	Significant Soil Subgroup(s) or Phase(s)	Drainage (see box B)	Soil Association Parent Material	Elevation Range (meters)	Forest Zone
Avis (AS)	AS1	Orthic Regosol	r,w			very coarse to medium textured alluvium	460-1370	Interior western hemlock-western red cedar complex
	AS2	Orthic Regosol	r,w	Gleyed Orthic Regosol Orthic Gleysol	i p,v			
	AS3	Orthic Regosol	r,w	Orthic Dystric Brunisol Gleyed subgroups	r,w i			
	AS4	Orthic Regosol	r,w	Orthic Humo-Ferric Podzol Gleyed subroups	r,w i			
	AS5	Gleyed Orthic Regosol	i	Orthic Regosol	r,w			
	AS6	Orthic Humic Gleysol	p,v	Gleyed Orthic Regosol Orthic Gleysol	p,v			
Beatrice (BC)	BC1	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol Seepage phases	r i	shallow, moderately coarse and very coarse textured colluvium over coarse-grained bedrock	1770-2200	Subalpine Engelmann spruce-alpine fir
	BC2	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Lithic subgroups Seepage phases	m m r i			
	BC3	Orthic Humo-Ferric Podzol	w,r	Sombric Humo-Ferric Podzol - alpine phase Lithic subgroups Seepage phases	m w,r i			
	BC4	Lithic Humo-Ferric Podzol	r	Orthic Humo-Ferric Podzol Seepage phases	w,r i			
Burdett (BE)	BE1	Orthic Eutric Brunisol	w,r			shallow, medium and moderately fine textured colluvium, glacial till or glaciolacustrine deposits over bedrock	420-910	Interior western hemlock-western red cedar complex**
	BE2	Orthic Eutric Brunisol	w,r	Orthic Dystric Brunisol Lithic subroups	w,r r			
	BE4	Lithic Eutric Brunisol	r	Orthic Eutric Brunisol	w,r			
Bonnington (BG)	BG1	Orthic Dystric Brunisol	r	Lithic Dystric Brunisol	r	shallow, moderately coarse and very coarse textured colluvium or glacial till over coarse-grained bedrock	420-1220	Interior western hemlock-western red cedar complex**
	BG3	Orthic Dystric Brunisol	r	Orthic Humo-Ferric Podzol Lithic subgroups	r,w r			
	BG6	Lithic Dystric Brunisol	r	Orthic Dystric Brunisol	r			
Buhl Creek (BH)	BH1	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol	r	shallow, moderately coarse and very coarse textured colluvium over coarse-grained bedrock	760-1770	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann spruce-alpine fir
	BH2	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol Seepage phases	r i			
	BH3	Orthic Humo-Ferric Podzol	w,r	Orthic Dystric Brunisol Lithic subroups	w,r r			
	BH4	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Lithic subgroups Seepage phases	m m r i			
	BH5	Orthic Humo-Ferric Podzol	w,r	Orthic Regosol Lithic subgroups	r r			
	BH6	Lithic Humo-Ferric Podzol	r	Orthic Humo-Ferric Podzol	w,r			
Bohan Creek (BK)	BK1	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol	r	shallow, moderately coarse textured colluvium over medium-grained bedrock	760-1770	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann Spruce-alpine fir
	BK2	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol Seepage phases	r i			
	BK3	Orthic Humo-Ferric Podzol	w,r	Orthic Dystric Brunisol Lithic subgroups	w,r r			
	BK4	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Lithic subgroups Seepage phases	m m r i			
	BK6	Lithic Humo-Ferric Podzol	r	Orthic Humo-Ferric Podzol	w,r			
Burtontown (BM)	BM1	Orthic Dystric Brunisol	r	Lithic Dystric Brunisol	r	shallow, medium and coarse textured colluvium over medium-grained bedrock	420-1220	Interior western hemlock-western red cedar complex**
	BM3	Orthic Dystric Brunisol	r	Orthic Humo-Ferric Podzol Lithic subgroups	r,w r			
	BM5	Orthic Dystric Brunisol	r	Orthic Eutric Brunisol Lithic subgroups	r r			
	BM6	Lithic Dystric Brunisol	r	Orthic Dystric Brunisol	r			
Bonner (BO)	BO1	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol Seepage phases	r i	shallow, moderately coarse textured colluvium over medium-grained bedrock	1770-2200	Subalpine Engelmann spruce-alpine fir
	BO2	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Lithic subgroups Seepage phases	m m r i			
	BO3	Orthic Humo-Ferric Podzol	w,r	Sombric Humo-Ferric Podzol - alpine phase Lithic subgroups Seepage phases	m r i			
	BO4	Lithic Humo-Ferric Podzol	w,r	Orthic Humo-Ferric Podzol Seepage phases	w i			

TABLE 1 (Continued)

Burn Creek (BU)	BU1	Orthic Humo-Ferric Podzol	w	Lithic Humo-Ferric Podzol Seepage phases	r i	shallow, medium and moderately fine textured colluvium over fine-grained bedrock	1770-2200	Subalpine Engelmann spruce-alpine fir
	BU2	Orthic Humo-Ferric Podzol	w	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Lithic subgroups Seepage phases	m m r i			
	BU3	Orthic Humo-Ferric Podzol	w	Sombric Humo-Ferric Podzol - alpine phase Lithic subgroups Seepage phases	m w,r i			
	BU4	Lithic Humo-Ferric Podzol	w,r	Orthic Humo-Ferric Podzol Seepage phases	w i			
Blizzard (BZ)	BZ1	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol	r	shallow, medium and moderately fine textured colluvium over fine-grained bedrock	760-1770	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann spruce-alpine fir
	BZ2	Orthic Humo-Ferric Podzol	w,r	Lithic Humo-Ferric Podzol Seepage phases	r i			
	BZ3	Orthic Humo-Ferric Podzol	w,r	Orthic Dystric Brunisol Lithic subgroups	w,r r			
	BZ4	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Lithic subgroups Seepage phases	m m r i			
	BZ6	Lithic Humo-Ferric Podzol	r	Orthic Humo-Ferric Podzol	w,r			
Castlegar (CA)	CA1	Orthic Dystric Brunisol	r	Orthic Eutric Brunisol	r	deep, moderately coarse and very coarse textured colluvium	420-1220	Interior western hemlock-western red cedar complex**
	CA2	Orthic Dystric Brunisol	r	Seepage phase	i			
	CA3	Orthic Dystric Brunisol	r	Orthic Humo-Ferric Podzol Seepage phases	r i			
Cayuse (CE)	CE1	Orthic Dystric Brunisol	w,r			deep, medium and moderately coarse textured colluvium	420-1220	Interior western hemlock-western red cedar complex**
	CE3	Orthic Dystric Brunisol	w,r	Orthic Humo-Ferric Podzol Seepage phases	w,r i			
	CE4	Orthic Dystric Brunisol	w,r	Orthic Eutric Brunisol Orthic Regosol	w,r r			
Clifty (CF)	CF1	Orthic Humo-Ferric Podzol	w,r	Seepage phase	i	deep, moderately coarse and very coarse textured colluvium	1770-2200	Subalpine Engelmann spruce-alpine fir
	CF2	Orthic Humo-Ferric Podzol	w	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m,i m,i i			
Champion (CH)	CH1	Orthic Humo-Ferric Podzol	w,r	Seepage phase	i	deep, medium and moderately coarse textured colluvium	1770-2200	Subalpine Engelmann spruce-alpine fir
	CH2	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m,i m,i i			
Calamity (CL)	CL1	Orthic Humo-Ferric Podzol	w,r			deep, medium and moderately coarse textured colluvium	760-1770	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann spruce-alpine fir
	CL2	Orthic Humo-Ferric Podzol	w,r	Seepage phase	i			
	CL3	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m,i m,i i			
	CL4	Orthic Humo-Ferric Podzol	w,r	Orthic Regosol	r			
	CL5	Orthic Humo-Ferric Podzol	w,r	Orthic Dystric Brunisol	w,r			
Creston (CN)	CN1	Orthic Eutric Brunisol	w			medium textured glacio-lacustrine and deltaic deposits	550-700	Interior western hemlock-western red cedar complex**
Cooper (CP)	CP1	Orthic Humo-Ferric Podzol	r			deep, moderately coarse and very coarse textured colluvium	760-1770	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann spruce-alpine fir
	CP2	Orthic Humo-Ferric Podzol	r	Seepage phase	i			
	CP3	Orthic Humo-Ferric Podzol	w,r	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m,i m,i i			
	CP4	Orthic Humo-Ferric Podzol	r	Orthic Regosol	r			
	CP5	Orthic Humo-Ferric Podzol	r	Orthic Dystric Brunisol	r			
Mount Cond (CS)	CS1	Sombric Humo-Ferric Podzol	m,i	Seepage phase	i	deep, medium and moderately coarse textured colluvium	910-2200	Interior western hemlock-western red cedar complex and Subalpine Engelmann spruce-alpine fir
	CS2	Sombric Humo-Ferric Podzol	m,i	Orthic Humo-Ferric Podzol Orthic Ferro-Humic Podzol Seepage phases	w m i			
Curtis (CT)	CT1	Sombric Humo-Ferric Podzol	m,i	Seepage phase	i	deep, moderately coarse and very coarse textured colluvium	910-2200	Interior western hemlock-western red cedar complex and Subalpine Engelmann spruce-alpine fir
	CT2	Sombric Humo-Ferric Podzol	m,i	Orthic Humo-Ferric Podzol Orthic Ferro-Humic Podzol Seepage phases	w m i			
Fletcher (FR)	FR1	Orthic Dystric Brunisol	r			gravelly, deep, moderately coarse and very coarse textured alluvial fan deposits	420-760	Interior western hemlock-western red cedar complex**
	FR2	Orthic Dystric Brunisol	r	Orthic Regosol Gleyed subgroups	r i			
	FR3	Orthic Dystric Brunisol	r	Orthic Regosol Orthic Humo-Ferric Podzol Gleyed subgroups	r r i			
	FR	Orthic Regosol	r	Orthic Dystric Brunisol Gleyed subgroups	r i			

TABLE 1 (Continued)

Soil Assn. Name (Map Symbol)	Soil Assn. Component	Dominant Soil Subgroup	Drainage (see box 8)	Significant Soil Subgroup(s) or Phase(s)	Drainage (see box 8)	Soil Association Parent Material	Elevation Range (meters)	Forest Zone
Fruitvale (FT)	FT1	Orthic Humo-Ferric Podzol	r	Gleyed Humo-Ferric Podzol	i	gravelly, deep, moderately coarse and very coarse textured alluvial fan deposits	760-1520	Interior western hemlock-western red cedar complex
	FT2	Orthic Humo-Ferric Podzol	r	Orthic Dystric Brunisol Orthic Regosol Gleyed subgroups	r r i			
	FT3	Orthic Humo-Ferric Podzol	r	Orthic Regosol Gleyed subgroups	r i			
Gerelle (GE)	GE2	Orthic Sombric Brunisol	r	Orthic Dystric Brunisol	r	gravelly, moderately coarse and very coarse textured glaciofluvial deposits	410-610	Interior western hemlock-western red cedar complex**
Glade (GL)	GL1	Orthic Sombric Brunisol	r			moderately coarse and very coarse textured glaciofluvial deposits	410-610	Interior western hemlock-western red cedar complex**
	GL2	Orthic Sombric Brunisol	r	Orthic Dystric Brunisol	r			
Groom (GR)	GR1	Orthic Humo-Ferric Podzol	r			gravelly, moderately coarse and very coarse textured glaciofluvial deposits	760-1520	Interior western hemlock-western red cedar complex
	GR2	Orthic Humo-Ferric Podzol	r	Seepage phase	i			
	GR3	Orthic Humo-Ferric Podzol	r	Orthic Dystric Brunisol	r			
Gillis (GS)	GS1	Orthic Dystric Brunisol	r			moderately coarse and very coarse textured glaciofluvial deposits	410-760	Interior western hemlock-western red cedar complex**
	GS4	Orthic Dystric Brunisol	r	Orthic Humo-Ferric Podzol	r			
	GS5	Orthic Dystric Brunisol	r	Orthic Sombric Brunisol	r			
Glenlily (GY)	GY2	Orthic Dystric Brunisol	r	Degraded Dystric Brunisol	r	gravelly, moderately coarse and very coarse textured glaciofluvial deposits	410-910	Interior western hemlock-western red cedar complex**
	GY4	Orthic Dystric Brunisol	r	Orthic Humo-Ferric Podzol	r			
Kuskanook (KK)	KK1	Carbonated Orthic Gleysol	p			medium and moderately fine textured alluvial deposits	530-540	Interior western hemlock-western red cedar complex*
	KK2	Carbonated Orthic Gleysol	p	Carbonated Rego Gleysol	v			
	KK3	Carbonated Orthic Gleysol	p	Low Humic Eluviated Gleysol	p			
	KK4	Carbonated Rego Gleysol	v	Carbonated Orthic Gleysol	p			
	KK5	Rego Humic Gleysol	p	Carbonated Orthic Gleysol	p			
	KK6	Orthic Regosol	m					
	KK7	Gleyed Orthic Regosol	i					
	KK8	Gleyed Orthic Regosol	i	Carbonated Orthic Gleysol	p,v			
Kaslo (KO)	KO1	Orthic Humo-Ferric Podzol	r			gravelly, moderately coarse and very coarse textured glaciofluvial ice-contact deposits	760-1770	Interior western hemlock-western red cedar complex
	KO2	Orthic Humo-Ferric Podzol	r	Seepage phase	i			
	KO3	Orthic Humo-Ferric Podzol	r	Orthic Ferro-Humic Podzol Seepage phases	m i			
	KO4	Orthic Humo-Ferric Podzol	r	Orthic Dystric Brunisol	r			
Kinert (KR)	KR2	Orthic Dystric Brunisol	r			gravelly, moderately coarse and very coarse textured glaciofluvial ice-contact deposits	420-910	Interior western hemlock-western red cedar complex**
	KR3	Orthic Dystric Brunisol	r	Orthic Sombric Brunisol	r			
	KR4	Orthic Dystric Brunisol	r	Orthic Humo-Ferric Podzol	r			
	KR5	Orthic Dystric Brunisol	r	Orthic Eutric Brunisol	r			
Leach (LH)	LH1	Carbonated Rego Gleysol	p,v			medium and moderately fine textured alluvial deposits	530-535	Interior western hemlock-western red cedar complex**
	LH2	Rego Gleysol	p,v	Carbonated Rego Gleysol	p,v			
Lister (LR)	LR1	Orthic Gray Luvisol	w			fine and very fine textured glacio-lacustrine deposits	580-700	Interior western hemlock-western red cedar complex
	LR2	Orthic Gray Luvisol	w	Gleyed Gray Luvisol	i			
Lawley (LY)	LY1	Brunisolic Gray Luvisol	w	Orthic Dystric Brunisol	w	moderately fine textured glaciolacustrine deposits	460-1070	Interior western hemlock-western red cedar complex**
	LY2	Brunisolic Gray Luvisol	w	Orthic Gray Luvisol	w			
	LY3	Brunisolic Gray Luvisol	w					
	LY4	Brunisolic Gray Luvisol	w	Bisequa Humo-Ferric Podzol Seepage phases	w i			
Kossland (RL)	RL1	Sombric Humo-Ferric Podzol - alpine phase	w	Sombric Ferro-Humic Podzol - alpine phase Lithic subgroups	w r	shallow, medium to very coarse textured colluvium over bedrock	2100-2700	Subalpine Engelmann spruce-alpine fir***
	RL2	Sombric Humo-Ferric Podzol - alpine phase	w	Sombric Ferro-Humic Podzol - alpine phase Orthic Humo-Ferric Podzol Lithic subgroups Seepage phases	w w r i			
	RL3	Lithic Sombric Humo-Ferric Podzol - alpine phase	r	Sombric Humo-Ferric Podzol - alpine phase Sombric Ferro-Humic Podzol - alpine phase	w w			
Sandon (SA)	SA1	Orthic Humo-Ferric Podzol	m,w	Seepage phase	i	gravelly, medium and moderately coarse textured basal till	1770-2200	Subalpine Engelmann spruce-alpine fir
	SA2	Orthic Humo-Ferric Podzol	m,w	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m m,i i			

TABLE 1 (Continued)

Syringa (SG)	SG1	Orthic Dystric Brunisol	w			gravelly, moderately coarse to moderately fine textured basal till	420-1220	Interior western hemlock-western red cedar complex**
	SG3	Orthic Dystric Brunisol	w	Orthic Humo-Ferric Podzol	w			
	SG4	Orthic Dystric Brunisol	w	Orthic Humo-Ferric Podzol Seepage phases	w i			
	SG5	Orthic Dystric Brunisol	w	Brunisolic Gray Luvisol Orthic Eutric Brunisol	w w			
Swehaw (SH)	SH1	Orthic Humo-Ferric Podzol	m	Seepage phase	i	gravelly, moderately coarse and very coarse textured basal till	1770-2200	Subalpine Engelmann spruce-alpine fir
	SH2	Orthic Humo-Ferric Podzol	m	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m m,i i			
Sentinel (SL)	SL1	Orthic Humo-Ferric Podzol	w			gravelly, medium and moderately coarse textured basal till	910-1700	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann spruce-alpine fir
	SL2	Orthic Humo-Ferric Podzol	w	Seepage phase	i			
	SL3	Orthic Humo-Ferric Podzol	w	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m m,i i			
	SL5	Orthic Humo-Ferric Podzol	w	Orthic Dystric Brunisol	w			
	SL6	Orthic Humo-Ferric Podzol	w	Bisequa Humo-Ferric Podzol Seepage phases	w i			
Slocan (SN)	SN1	Orthic Humo-Ferric Podzol	w			gravelly, very coarse and moderately coarse textured basal till	910-1770	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann spruce-alpine fir
	SN2	Orthic Humo-Ferric Podzol	w	Seepage phase	i			
	SN3	Orthic Humo-Ferric Podzol	w	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m m,i i			
	SN5	Orthic Humo-Ferric Podzol	w	Orthic Dystric Brunisol	w			
	SN6	Orthic Humo-Ferric Podzol	w	Bisequa Humo-Ferric Podzol Seepage phases	w i			
Salmo (SO)	SO1	Orthic Dystric Brunisol	w,r			gravelly, moderately coarse and very coarse textured basal till	420-1220	Interior western hemlock-western red cedar complex**
	SO2	Orthic Dystric Brunisol	w,r	Seepage phase	i			
	SO3	Orthic Dystric Brunisol	w,r	Orthic Humo-Ferric Podzol	w,r			
	SO5	Orthic Dystric Brunisol	w,r	Brunisolic Gray Luvisol Orthic Eutric Brunisol	w w			
Shields (SS)	SS1	Bisequa Humo-Ferric Podzol	w	Seepage phase	i	moderately coarse and medium textured basal till	910-1770	Interior western hemlock-western red cedar complex and lower part of Subalpine Engelmann spruce-alpine fir
	SS2	Bisequa Humo-Ferric Podzol	w	Orthic Humo-Ferric Podzol Seepage phases	w i			
	SS3	Bisequa Humo-Ferric Podzol	w	Orthic Ferro-Humic Podzol Sombric Humo-Ferric Podzol Seepage phases	m m,i i			
	SS4	Bisequa Humo-Ferric Podzol	w	Brunisolic Gray Luvisol	w			
Skelly (SY)	SY1	Brunisolic Gray Luvisol	w	Orthic Dystric Brunisol	w	moderately coarse and medium textured basal till	420-1220	Interior western hemlock-western red cedar complex**
	SY2	Brunisolic Gray Luvisol	w	Orthic Eutric Brunisol	w			
	SY3	Brunisolic Gray Luvisol	w	Orthic Gray Luvisol	w			
	SY4	Brunisolic Gray Luvisol	w	Orthic Humo-Ferric Podzol Seepage phases	w i			
	SY5	Brunisolic Gray Luvisol	w	Bisequa Humo-Ferric Podzol Seepage phases	w i			
Trial (TL)	TL1	Orthic Humo-Ferric Podzol	r			gravelly, moderately coarse and very coarse textured ablation till	1220-1520	Subalpine Engelmann spruce-alpine fir
Tye (TY)	TY1	Orthic Gray Luvisol	w			medium and moderately fine textured basal till	540-730	Interior western hemlock-western red cedar complex**
	TY2	Orthic Gray Luvisol	w	Brunisolic Gray Luvisol	w			
Ymir (YR)	YR1	Orthic Regosol	r			loose, stony and bouldery colluvium	460-2740	Interior western hemlock and Subalpine Engelmann spruce-alpine fir
	YR2	Orthic Regosol	r	Orthic Humo-Ferric Podzol	r			

Miscellaneous Land Types

Glacier	I	Permanent ice and snow
Organic deposits	O	Deposits of undecomposed to decomposed organic material
Bedrock	RO	Bedrock exposed at or within 10 cm of the land surface

* edaphic conditions generally favour black cottonwood climax forests.

** edaphic conditions generally favour Douglas-fir climax forests.

*** generaly consists of the krummholz subzone with inclusions of alpine areas.

TABLE 2
VEGETATION SOIL RELATIONSHIPS

Soil Association Name (Map Symbol)	Soil Association Component	Vegetation Types[1]
Avis (AS)	AS1	22
	AS2	22, 10d
	AS3	22, 10d
	AS4	22, 10, 3, 46
	AS5	22
	AS6	3, 22
Beatrice (BC)	BC1	8, 3, 10a, 1, 16
	BC2	41b, 10b
	BC3	7, 5
	BC4	8
Burdett (BE)	BE1	11, 15
	BE2	13, 15
	BE4	11, 13
Bonnington (BG)	BG1	26, 12, 13
	BG3	27, 12, 13, 29
	BG6	11, 13, 15
Buhl Creek (BH)	BH1	11, 12, 39
	BH2	15, 17, 19, 21, 32
	BH3	12, 19
	BH4	10c
	BH5	3
	BH6	4
Bohan Creek (BK)	BK1	4, 9, 23, 26, 29, 20, 10a, 21, 39, 43, 44
	BK2	26, 4
	BK3	19
	BK6	33a, 42
Burtontown (BN)	BN1	12, 13, 15, 33a
	BN3	19, 29
	BN5	15, 11
	BN6	15, 11

[1] Numbers refer to type names of Table 3.

TABLE 2 (Continued)

Soil Association Name (Map Symbol)	Soil Association Component	Vegetation Types[1]
Bonner (BO)	BO1 BO3 BO4	7 5, 7 5
Burn Creek (BU)	BU1 BU2 BU3 BU4	1, 7, 8 7, 8 7 8, 1
Blizzard (BZ)	BZ1	1, 13
Castlegar (CA)	CA1 CA2 CA3	11 11 19
Cayuse (CE)	CE1 CE2 CE4	24, 27, 32, 33b 16 11, 24, 27, 33b
Clify (CF)	CF1 CF2	6b 6c, 6d, 7, 8
Champion (CH)	CH1 CH2	6b 6c, 8, 7
Calamity (CL)	CL1 CL2 CL3 CL4 CL5	1, 20, 34, 38, 40, 42 3, 10a, 17, 18, 39, 43 2, 3, 7, 10a, 10b 24 27, 33b, 37
Cooper (CP)	CP1 CP2 CP3 CP4 CP5	1, 4, 40, 42 2, 3, 10c, 17, 18, 24, 44 2, 3, 7, 10b 43, 44, 10c 24 27, 33b

[1] Numbers refer to type names of Table 3.

TABLE 2 (Continued)

Soil Association Name (Map Symbol)	Soil Association Component	Vegetation Types[1]
Mount Cond (CS)	CS1 CS2	10b 10a, 10b, 20
Curtis (CT)	CT1 CT2	10b 2, 4, 10a, 10b
Fletcher (FR)	FR1 FR2 FR3 FR5	13, 36, 43 30, 30 3, 32, 36, 46 22
Fruitvale (FT)	FT1 FT2 FT3	3, 17, 32 36, 46 3, 36
Genelle (GE)	GE2	13
Glade (GL)	GL1 GL2	13 13
Groom (GR)	GR1 GR2 GR3	20, 32 3, 17 28, 38
Gillis (GS)	GS1 GS2 GS3	25, 35 38 13
Glenlily (GY)	GY2 GY4	26, 31, 35, 36, 38 24, 28
Kuskanook (KK)	KK1 KK6 KK7 KK8	Marsh-sedge communities treeless 22 22 22

[1] Numbers refer to type names of Table 3.

TABLE 2 (Continued)

Soil Association Name (Map Symbol)	Soil Association Component	Vegetation Types[1]
Kaslo (KO)	KO1	18, 21, 24, 30, 36, 40, 44
	KO2	1, 2, 3, 4, 9, 10b, 17, 39
	KO3	1, 2, 3, 4, 9, 17
	KO4	16, 17, 21, 38, 39
Kinert (KR)	KR2	13, 31, 33b, 35, 37
	KR4	24, 32, 33b
	KR5	11, 13, 26
Leach (LH)	LH1	Sedge marsh community
	LH2	
Lister (LR)	LR1	18
Lawley (LY)	LY1	20
	LY2	18
	LY3	20
Rossland (RL)	RL1	5, 6b, 14b
	RL2	5, 14a, 14b
	RL3	5, 14b
Sandon (SA)	SA1	6c, 8, 9
	SA2	6a, 7, 8, 9
Syringa (SG)	SG1	11, 13, 23, 29
	SG3	21
	SG5	13, 16, 22
Swehaw (SH)	SH1	2
	SH2	7, 8, 9, 10a
Sentinel (SL)	SL1	19, 39, 40
	SL2	9, 10a, 10c, 41a
	SL3	10a, 40
	SL5	16, 24, 38
	SL6	4, 21, 24, 36, 43

[1] Numbers refer to type names of Table 3.

TABLE 2 (Continued)

Soil Association Name (Map Symbol)	Soil Association Component	Vegetation Types[1]
Slocan (SN)	SN1	19, 20, 29, 39, 40
	SN2	1, 10a, 20, 40, 41a, 44
	SN3	1, 10a
	SN5	19, 20, 29
	SN6	2, 3, 21, 36
Salmo (SO)	SO1	11, 13, 23, 29
	SO2	23, 29
	SO3	21, 28
	SO5	11, 13, 16
Shields (SS)	SS1	3, 6b, 17, 21, 32, 33, 38, 40
	SS2	10a, 39, 44, 45
	SS3	3, 10a, 18, 40
	SS4	16, 24, 25, 38
Skelly (SK)	SY1	12, 13
	SY2	11, 13, 16, 26, 33b
	SY3	30
	SY4	26
	SY5	16
Trial (TL)	TL1	4, 39
Tye (TY)	TY1	18, 29
	TY2	30
Ymir (YR)	YR1	14a, 47
	YR2	1

[1] Numbers refer to type names of Table 3.

TABLE 3
LIST OF VEGETATION TYPES

VEG. TYPE NO.	VEGETATION TYPE NAME	VEG. TYPE NO.	VEGETATION TYPE NAME
1	Alpine fir - western hemlock - rhododendron - bluebead clintonia - foam flower.	8	alpine fir - rhododendron-many-flowered one-sided wintergreen-green stemmed pipe-cleaner.
2	Engelmann spruce - western hemlock - twisted stalk - green-stemmed pipecleaner.	9	alpine fir - rhododendron-broad-leaved arnica - foam flower.
3	western hemlock - Engelmann spruce - common lady fern - oak fern.	10a	Engelmann spruce - meadow rue - foam flower.
4	western hemlock - western yew - devil's club - oak fern.	10b	Engelmann spruce - black blueberry - lady fern - viola.
5	rhododendron - alpine fir - cassiope - mountain heather complex.	10c	western hemlock - devil's club - lady fern - mnium moss.
6a	western pasqueflower - western swamp kalmia.	10d	western red cedar-western thimbleberry - ginger root - silvergreen.
6b	black blueberry - grouseberry - bear-grass - whitebark pine.	10e	Engelmann spruce-mountain alder - western bracken-false hellebore.
6c	white-flowered rhododendron - alpine fir - bracted lousewort - sickle-top lousewort.	11	Rocky Mountain Douglas-fir - snowberry - small reed grass - wheat grass.
6d	alpine fir - lupine - subalp. daisy fleabane-louseworts.	12	Rocky Mountain Douglas-fir - small reed grass - western fescue.
7	alpine fir - rhododendron - false hellebore - wood-rush.	13	Rocky Mountain Douglas-fir - snowberry-fairybells - pine grass complex.

TABLE 3 (Continued)

VEG. TYPE NO.	VEGETATION TYPE NAME	VEG. TYPE NO.	VEGETATION TYPE NAME
14a	bear-grass - aster - meadow rue-Indian paintbrush.	23	Rocky Mountain Douglas-fir - trembling aspen western bracken- baldhip rose.
14b	blue grass - anemone.	24	trembling aspen - paper birch - western thimbleberry - western bracken.
15	Rocky Mountain Douglas-fir - saskatoon - small reed grass - western fescue complex.	25	paper birch - western bracken - small reed grass-sweetcicely.
16	lodgepole pine - willow - ceanothus - pine grass.	26	Rocky Mountain Douglas-fir-snowberry - fairybells - sweetcicely.
17	western hemlock - devil's club - blue-bead clintonia - foam flower.	27	Rocky Mountain Douglas-fir-paper birch - Oregon grape-fairybells.
18	western hemlock - western white pine - large-leaved rattlesnake orchid - common moss.	28	Rocky Mountain Douglas-fir-rose - small reed grass - spreading dogbane.
19	Rocky Mountain Douglas-fir - western white pine - spirea - blue-bead clintonia.	29	western red cedar - grand fir - small reed grass - fescue.
20	western red cedar - Utah honeysuckle - western yew - blue-bead clintonia.	30	western larch - western red cedar - rose - blue-bead clintonia.
21	western hemlock-Oregon winter-green - blue-bead clintonia - green-stemmed pipecleaner.	31	Rocky Mountain Douglas-fir-filbert-western trumpet honeysuckle-wild sarsaparilla.
22	black cottonwood - red-osier dogwood - snowberry - sweet-scented bedstraw.	32	western larch-western red cedar-western thimbleberry-northern twinflower.

TABLE 3 (Continued)

VEG. TYPE NO.	VEGETATION TYPE NAME	VEG. TYPE NO.	VEGETATION TYPE NAME
33a	Rocky Mountain Douglas-fir - spirea - small reed grass - arnica.	40	western hemlock - alpine fir - black blueberry - evergreen yellow violet.
33b	lodgepole pine - rose - many-flowered one-sided winter - green - small reed grass.	41a	trembling aspen - willow - common pearly everlasting - hairy-cap moss.
33c	lodgepole pine - western hemlock - blue-bead clintonia-twisted stalk.	41b	lodgepole pine - rhododendron - common pearly everlasting-hairy-cap moss.
34	western thimbleberry - soopalallie - blue-bead clintonia - western bracken.	42	black blueberry - Oregon boxwood - western thimble - berry - Oregon grape.
35	lodgepole pine - Oregon boxwood - saskatoon - small reed grass.	43	western larch - Scouler's willow - twinberry honey-suckle - grouseberry.
36	western larch - Oregon boxwood - saskatoon - small reed grass.	44	western larch - western red cedar - blue-bead violet.
37	lodgepole pine - western red cedar - northern twinflower-wood strawberry.	45	western red cedar - western birch.
38	lodgepole pine - soopolallie-western bracken - red-stemmed pipecleaner.	46	Rocky Mountain maple - sarsaparilla - sweet-scented bedstraw.
39	lodgepole pine - Engelmann spruce - Oregon boxwood - common western pipsissewa.	47	Engelmann spruce - Oregon boxwood - beargrass.